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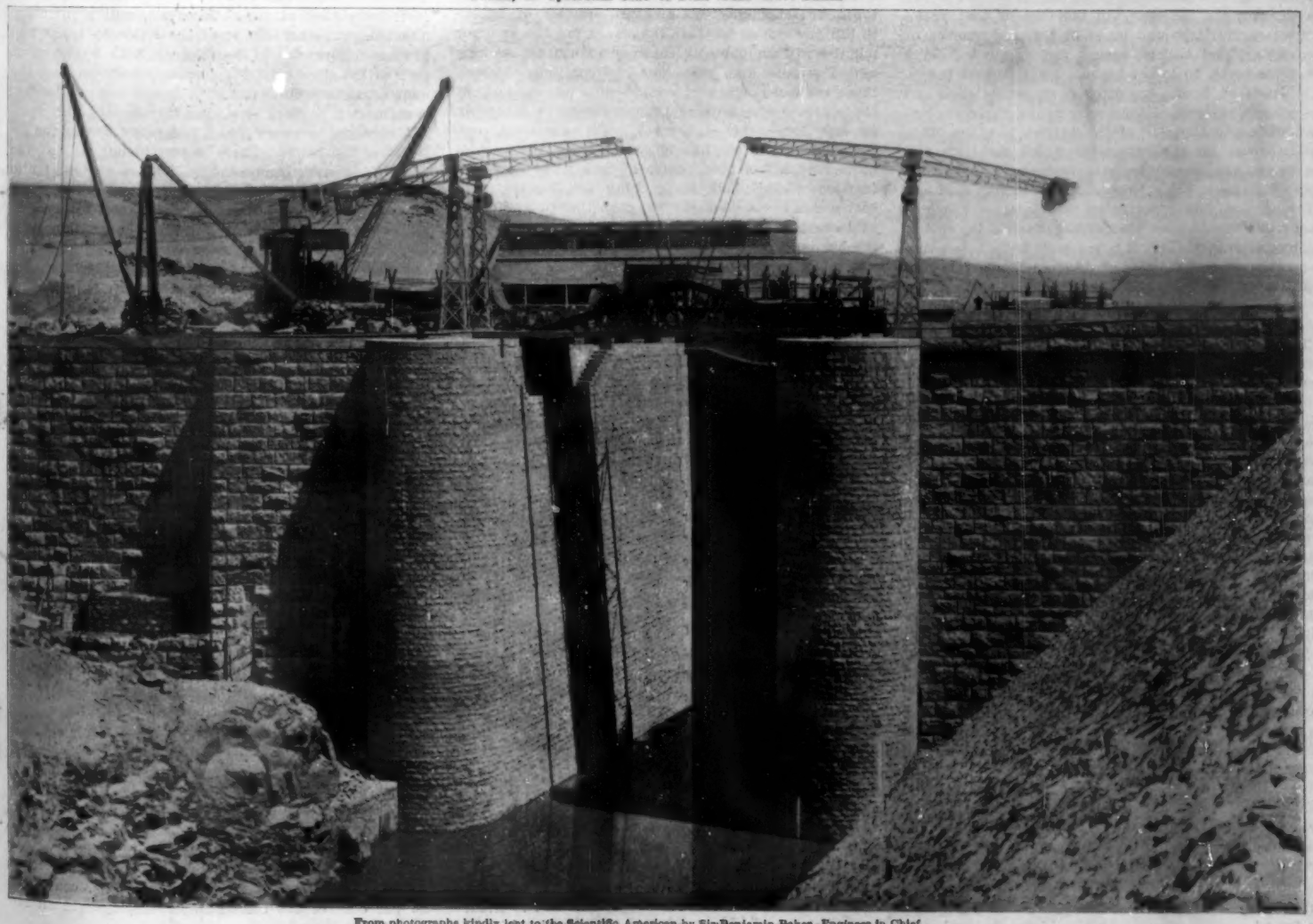
Total length, 1¼ miles; maximum height above foundation, 180 feet; difference of water level above and below, 67 feet. Total weight of masonry, over 1,000,000 tons.

South, or Upstream Side of Dam from West Bank.



From photographs kindly lent to the Scientific American by Sir Benjamin Baker, Engineer in Chief.

Entrance to Locks of Navigation Channel from the South.

THE DAMMING OF THE NILE—THE GREAT DAM AT ASSOUAN.—[See page 189.]

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NEW YORK, SATURDAY, SEPTEMBER 20, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE SPEED TRIALS OF THE "ARROW."

Although, as we have shown elsewhere in this issue, there is no reason seriously to doubt the accuracy either of the course or of the timing in the recent speed trials of the steam yacht "Arrow," it is greatly to be regretted that the trials were so limited in duration and that advantage was not taken of this opportunity to secure most valuable data regarding a very remarkable craft. As we understand it, there was no intention of making more than a single run over the official course, not even a pound of coal being allowed to remain on board beyond what was sufficient for the run. Consequently the trial was purely spectacular, and possesses no practical value. When we consider that the "Arrow," in spite of the blundering by which her steam was allowed to run down over the latter part of the course, came so near to achieving her designed speed of forty knots an hour, we cannot but feel that it is a pity that the vessel was not sent over the course for several consecutive runs, and given an opportunity to prove whether she was capable of a sustained burst of speed on a continuous run of five or six miles. Her trial would thus have taken rank, as a test of speed, with the trials of the torpedo boat destroyers, among which vessels she should rightly be classed.

Indeed, it cannot be looked upon as anything but a distinct loss to the scientific world that the trials of the "Arrow" were not carried out in the scientific manner which characterized the trials of her predecessor, the "Ellide." In the case of that vessel a most careful test was made of the performance of the engines and boilers during various runs, from a moderate speed up to her highest speed of over thirty-four knots an hour. Indicator cards were taken and a thorough analysis of the performance of the engines was made. In the case of the "Arrow," on the other hand, except for the care with which the time was taken, the trial seems to have been carried out in a very amateurish way. Not a single indicator card was taken, and a fine opportunity was lost for securing data which would have been of the greatest interest to the engineering world. It is sincerely to be hoped that the owner of the vessel will decide to have a test of this kind made before placing her out of commission.

THE IRRIGATION OF THE NILE VALLEY.

The latter months of this year will prove a red-letter day in the annals of modern Egypt, for before the year is closed the huge irrigation works on the Nile will be completed and opened for use. The ceremony of inauguration promises to be as important as that which attended the opening of the Suez canal. Whatever may be said politically concerning the English occupation of Egypt, there is no denying that, judged from the commercial and industrial point of view, England has achieved a notable success in her attempt to improve the arable conditions of the land and the social conditions of the Egyptian people. The vast irrigation works have occupied about four years in construction and have been pushed forward with such rapidity that they have been completed several months before the contracted time.

The Nile reservoir at Assouan has a total capacity of over 1,000,000,000 tons of water. It is scarcely possible to realize what this huge storage of water for irrigation purposes signifies to Egypt. Two years ago, when the Nile was below the average in summer discharge, it was decreed in Upper Egypt that between the middle of April and the middle of July the primitive "lifting machines" in vogue, which include the shadoof, or bucket and pole system, and the sakieh, or oxen-driven chain of buckets, should be worked not more than from five to eleven consecutive days, and should stop the following nine to thirteen days; and the order in which the different districts were to receive a supply was carefully specified, so that, as far as possible, every crop should get watered once in about three weeks. When it is remembered that a single watering of an acre of land means, where shadoofs are concerned, raising by manual power about 400 tons of water to varying heights up to 25 feet, and that four or five waterings are required to raise a summer crop, it will be seen what a vast amount of human labor is saved throughout the world by the providential circumstance that in ordinary cases water falls from the clouds, and has not, as in Egypt, to be dragged up from channels and wells. Shadoof work, under average conditions, invoives one man's labor for at least one hundred days for each acre of summer crop; so that even at 10 cents per day for labor the extra cost of cultivation due to the absence of rain would amount to $10 per acre.

The great Nile reservoir and dam at Assouan, the barrage at Assiout, and various supplementary works in the way of distributing canals and regulators, are designed with the object of mitigating the evils due to the drought of summer by supplying in summer a large volume of water at a higher level in the canals, so that not only more land may be irrigated, but the labor of lifting water be saved.

The barrages are already supplying a comprehensive demonstration of what benefit they will bestow upon the country. This year the Nile is abnormally low, and the prospects of the country would be very grave were it not for the existence of the dams, which have saved the situation. The Assiout dam is acting splendidly and has raised the level of the water in the Ibrahimich canal 58 inches and practically saved Middle Egypt. The revenue derived from the benefit already bestowed this year by this dam will go a long way toward defraying its cost.

SOFT COAL FOR DOMESTIC USE.

In view of the fact that although autumn is upon us, the strike in the anthracite coal region is still in force, the householder is confronted with the problem as to whether he will pay ten or twelve dollars a ton for anthracite coal, or find some substitute for use in the cooking range and the heating furnace. The inconvenience caused by the coal strike was felt by all classes of the community, but it is upon the people of moderate means and upon the poor that the burden will fall with greatest weight; for to them the price of anthracite coal will be positively prohibitive.

At the same time it is possible to overestimate the difficulty of the situation; for although anthracite is the ideal fuel for cooking and heating purposes, it is not by any means the only one available. This has been proved by the enormous demand for gas stoves which has occurred during the past few weeks; and those householders who make a practice of substituting gas stoves for coal ranges during the summer months will undoubtedly continue to use gas as long as the present high prices for coal continue. Indeed, there are many who prefer to use this fuel throughout the whole year, claiming that it compares favorably in cost for cooking purposes with anthracite coal. Another substitute that is available is the coal-oil stove, which has been perfected to a point at which it may be used both for cooking and heating at a cost which is considerably less than that of anthracite coal or gas; while careful attention to the question of combustion has enabled the makers to put upon the market oil stoves which will do their work without producing unpleasant odors in the house.

Wood is, of course, too expensive a fuel, at least in the large cities, to be suggested as an alternative, even at the prevailing high price of anthracite; nor are the grates of the ordinary kitchen stove, or basement heater, altogether suited to the use of wood, although it could be burned in them at the cost of close attention. In such houses as have open fireplaces wood fuel can, of course, be used to great advantage, and in localities where wood fuel can be delivered at a reasonable figure, there is certain to be a marked increase in the sales of cord-wood. Indeed, we think that those farmers and owners of wood land that are advantageously placed as regards transportation, would find it to their interest to make arrangements for the delivery of cord-wood in the nearest towns and cities during the coming winter months.

Although electricity has been applied with a measure of success to the work of heating and cooking, it is not likely that there will be an appreciable increase in its use for these purposes, the cost being too high for the limited means of the average householder.

Although the fuels that we have mentioned will all be used to a greater or less extent, it is to soft or bituminous coal that the public will have to turn during the winter months as the cheapest and most satisfactory substitute for anthracite. After careful inquiry among the coal dealers and general coal interests, we are satisfied that when the public begins to buy soft coal, as it will have to do before very long, the dealers will be able to supply all that is needed at a cost not to exceed, even in the suburbs, $5 or $6 a ton. We are assured by one of the largest dealers that there is no doubt that, even if the strike should continue for several months longer, it would be possible for householders to obtain an abundance of bituminous coal at the price named and probably for something less. Nor is there any quality in soft coal which renders it unfit for domestic use. Indeed, as a matter of fact, practically no other fuel is used, or has been used, for domestic purposes in Great Britain, and while the cooking ranges differ somewhat in design from those used in this country for anthracite coal, it will be quite possible for the householder, by using a little judgment, to burn soft coal to advantage in the ordinary American cooking stove. The most important fact to remember is that the great quantities of gas thrown off when soft coal is first ignited render it necessary to supply considerably more air above the bed of fuel than is the case with anthracite coal. Thus, in replenishing the kitchen stove, it will not do to fill the grate entirely full of fresh fuel, since this would result in the rapid lowering of the oven temperature, which would not be restored until the mass had become ignited and the gases had been somewhat burned off. It will be found that the best method is to feed small quantities of fuel to the fire at frequent intervals, keeping the lower drafts closed more than they would be in burning anthracite coal, and keeping the upper draft constantly open. For use in the heating furnace, soft coal will be found to give good results when once the proper manipulation of the furnace has been learned. It should be understood at the outset that more constant attention will be necessary, for the reason that soft coal burns more quickly and will not remain incandescent for so long a time as anthracite coal. During the daytime the attendant will have no difficulty in keeping a steady fire if he is careful to feed the furnace frequently; to keep the bottom drafts but slightly open; and to give a liberal feed of air through the air inlet in the furnace door. Owing to the rapidity of combustion of bituminous coal it will not be possible to bank up the furnace for the night and leave it with a certainty that there will be a live fire remaining in the morning; but this difficulty can be overcome if a ton of anthracite is laid in with the winter's supply of soft coal, and the anthracite used only for banking up the fire over night. A ton of anthracite used for this purpose should suffice to tide the household over the period of high prices.

There is one feature connected with the use of soft coal, however, which, unless it be carefully safeguarded, may introduce an element of danger. We refer to the heavy deposit of soot in the flues which will occur when soft coal is used. This soot, unless it is swept out at stated intervals, will accumulate, and being inflammable would be liable to ignite and produce a fierce fire in the chimney, with a consequent risk to the dwelling. It sometimes happens that the ends of rafters or beams are, by careless or ignorant construction, allowed to project into the chimney flues. These might become ignited and carry fire to the interior of the house. There is further danger that the shower of sparks from a burning chimney would ignite the shingle roof of the suburban cottage. These risks may be obviated by sweeping the chimney, say once in two months. The "chimney sweep" is an important personage in the old countries, and it would be a curious incidental development of the strike if he should make his appearance, even temporarily, in this country.

For a more extended discussion of the possibilities of soft coal as a domestic fuel, reference is made to a lengthy article in the current issue of the SUPPLEMENT.

DISTRIBUTION OF INDUSTRIES.

The Census Bureau has issued a bulletin on the localization of industries, which shows that, measured by the value of products, more than 85 per cent of the collar and cuff manufacture is carried on in Troy, N. Y.; more than 64 per cent of the oyster canning industry in Baltimore; more than 54 per cent of the manufacture of gloves in the adjoining cities of Gloversville and Johnstown, N. Y.; more than 48 per cent of the coke manufacture in the Connellsville district, Pennsylvania; more than 47 per cent of the manufacture of brassware in Waterbury, Conn.; more than 45 per cent of the manufacture of carpets in Philadelphia; more than 45 per cent of the manufacture of jewelry in Providence, R. I., and the adjoining towns of Attleboro and North Attleboro, Mass.; more than 36 per cent of the silverware manufacture in Providence, R. I.; more than 35 per cent of the slaughtering and meat packing industry in Chicago; more than 32 per cent of the manufacture of plated and britannia ware in Meriden, Conn.; more than 24 per cent of the agricultural implement industry in Chicago, and more than 24 per cent of the silk industry in Paterson, N. J.

The number of wage earners engaged in slaughtering and meat packing in South Omaha, Neb., constitute 90 per cent of the total number employed in all industries in the city.

The iron and steel industry form 89 per cent of all

the industries in McKeesport, Penn.; the pottery industry, 87 per cent in East Liverpool, Ohio; the fur hat industry, 86 per cent in Bethel, Conn.; the glass industry, 81 per cent in Tarentum, Penn.; the cotton goods industry, 80 per cent in Fall River, Mass.; the boot and shoe indusry, 77 per cent in Brockton, Mass.; the silk manufacture, 76 per cent in West Hoboken, N. J.; glove manufacture, 75 per cent in Gloversville, N. Y.; jewelry manufacture, 72 per cent in North Attleboro, Mass., and the collar and cuff industry, 69 per cent in Troy, N. Y.

"ALL THE WORLD'S FIGHTING SHIPS."*

Although the English correspondents of American daily journals have argued that while popular enthusiasm over the various postponed functions connected with the late coronation was not aroused to any great extent, they have noted that there was one feature—the great review at Spithead—which awakened the most widespread and enthusiastic interest. British enthusiasm over the navy is natural; but although naval matters may less vitally affect their integrity and mean less to some other nations, there is no question that throughout the world there is evidence of an increasing desire to obtain something more than a superficial knowledge of ships, guns and armor. In this age of encyclopedias and text books, it is surprising, perhaps, that there are not more works devoted to the illustration and description of naval matters in general; on the other hand, if such works are few, those that exist are of high character and are generally marked by more or less official recognition.

Unquestionably the best work on the subject is F. T. Jane's "All the World's Fighting Ships," a book which has grown steadily in quality and reputation, and is to-day the best-known work of the kind among the navies of the world. In the latest edition of this work, just to hand, the best features of the previous editions have been retained and amplified, while the editor has not hesitated to use the pruning knife freely where experience has shown that certain features might with advantage be eliminated. It is not often that there is crowded within the limits of 380 pages such a vast amount of detailed information as is found in this book; although if we consider the ambitious nature of the work, the wide extent of the ground covered, it is a matter for surprise that the book is not even more bulky than it is. Thus the author undertakes to give a photograph, an outboard profile, and a deck plan, with the armored portion shown in shading, of one vessel of every class of warship in the world. On the plans are marked the size and position of every gun carried by the vessel, and the thickness and distribution of the armor. In addition to this, around each cut is a tabulated description of the armament, which gives the mark, the caliber and length of each gun, the thickness of armor on every armored portion of the vessel, a description of the style, size, and horse power of the engine and boilers; the dimensions, displacement, speed and coal supply of the vessel, and her complement. Moreover, if occasion calls for it, there is a foot-note below each cut giving particulars as to the performance, sea-speed, maneuvering qualities, etc., of each class that is illustrated.

A feature peculiar of this work which has met with great favor among naval men, is the placing beside the cut and diagram of each ship, of a silhouette of the vessel. Although in the case of any particular class of battleships or cruisers, there will be no important differences in the main features, such as the guns, smokestacks and masts, there may yet be differences of detail which will be sufficient to distinguish one vessel from another. These slight differences, such as in the height of the smokestacks, or the arrangement of steam pipes and ventilating cowls, are clearly shown in the silhouette, and since a warship that is distant more than three or four miles presents nothing more than a silhouette appearance, it can be seen how great is the value of this system of identification as provided in the work under review.

An important and welcome feature in the present edition is the elimination from it of all vessels that have no practical fighting value, such as vessels used for police duties only, training ships and obsolete battleships and cruisers. With this material cleared out of the way, it becomes possible to make a positive estimate of the fighting value of individual ships, of fleets, and of navies as a whole. This Mr. Jane has done in "All the World's Fighting Ships." He adopts a system of notation under which he gives certain values to the different offensive and defensive qualities, and by a summation of these he is able to classify every ship according to its fighting value. The qualities which are regarded in computing these values are gun power and armor protection, bulk and age (which affect endurance under fire), speed and handiness, seaworthiness and coal endurance. In making the classification it was realized by the author that the time had come for dropping once and for all the old hard-and-fast lines of demarkation between cruiser and battleship—an arbitrary distinction, which might give to an old or poorly-designed battleship a fictitious value, and might depreciate the relative fighting efficiency of another and better ship, merely because she bore the name of cruiser. Classes I. and II. contain the ships, whether battleships or cruisers, which, in active warfare will "lie in the line." Class III. contains the remaining ships of serious utility, while the other classes contain ships of only limited and restricted uses, from big, modern protected and belted cruisers and old battleships with unprotected guns, down to the miscellaneous smaller vessels. Another modifying factor in determining values is the present practice of estimating ships by displacement and age on the basis that 16 years of age knocks off from one-quarter to one-fifth of the value of displacement, 14,000 tons of 1892 being worth about 11,000 tons of to-day.

Naturally the description and illustration of practically every one of the world's fighting ships occupies the greater portion (some three hundred pages) of this book. Part II. contains a series of articles, by leading naval authorities of the world, on some of the burning questions of naval construction, material, and personnel. Among these writers are included such authorities as Col. Cuniberti, Chief Constructor of the Italian Navy, and Admiral Hopkins, Lord of the Admiralty of England. For many readers, the most interesting pages will be those containing comparative tables showing the relative strength of the navies of the world. The comparison of classes I., II. and III., in which the fighting values of the ships are determined by points, includes the best types of battleships and armored cruisers, and places England first with 45.6 points; France second with 16.2 points; Russia third with 14.4 points; Japan fourth with 10.4 points; Germany fifth with 8.8 points; and the United States sixth with 8.2 points. The above comparison takes account only of ships that are actually completed. The comparison, by points, of battleships and armored cruisers now under construction shows the United States to be first with 14.6 points; France second with 11.2 points; England third with 8.2 points; Germany fourth with 7.2 points; Russia fifth with 6.2 points, and Japan last with no ships of this class under construction. When these vessels that are building have been all completed, or say in 1905, the relative strength of the navies will show up very differently. The United States will have moved up from sixth to third position; England coming first with 53.8 points; France second with 27.4 points; United States third with 22.8 points, Russia fourth with 20.4 points; Germany fifth with 16 points, and Japan sixth with 10.4 points. We should here add that this very flattering estimate of the growing strength of our navy is based upon the expectation that the construction of our ships will proceed much faster than it has hitherto done.

It is impossible in concluding our review of this most valuable book, to do more than mention the many subjects which are treated in the second part. Of the various articles the one of most interest is that on Battleship Design by Col. Cuniberti, whose battleship "Victorio Emanuele" is regarded in many quarters as the permanent type of the future battleship. This vessel, by the way, which has the unprecedented battleship sea speed of 22 knots, carries two 12-inch guns, twelve 8-inch guns and twelve 4-inch guns, on the moderate displacement of 12,625 tons. Following Cuniberti's article are lengthy chapters on the Progress of Reconstruction, on the Advantage of Intermediates. (that is, battleships midway in size and power between the 18,000-ton battleship and the 10,000-ton cruiser) by Admiral Hopkins, who evidently considers the "Victorio Emanuele" to be the ideal intermediate craft. The Naval Maneuvers are treated exhaustively by contributors of various nationalities. There is a chapter on Trials and Experiments, in which the latest achievements in guns and armor are chronicled with elaborate diagrams and half-tone engravings; while under the head of Marine Engineering the question of the proper naval boiler is discussed at length by the aid of diagrams and half-tone plates.

Altogether the present edition of "All the World's Fighting Ships" may be taken as the best work of its kind offered to the public, an opinion which is indorsed by the fact that the book has received official recognition in the leading navies of the world.

*"All the World's Fighting Ships." By Fred T. Jane. New York. 1902. Published by Munn & Co.

INTERNATIONAL MINING CONGRESS—BUTTE MEETING.

The meeting of the International Mining Congress at Butte, Mont., September 5, is conceded to have been the largest and most important gathering of the kind ever held in America, or perhaps anywhere else. It was, moreover, strictly an American gathering, the single Mexican present not warranting the title "international," which has now, after a heated contest, been dropped, and the name of the association changed to "American Mining Congress."

A notable feature of the meeting was the magnificent exhibition of minerals at Columbia Gardens in Butte under the direction of Mr. J. R. Wharton.

The Kearns bill, which would limit the number of mining claims to a single one for every locator, and would also limit mining to the region underlying the superficial area, thus cutting off extra-lateral mining, was condemned by an almost unanimous vote.

Resolutions were adopted favoring the creation of a new cabinet office, that of Secretary of Mining, and strenuous efforts will be made to secure legislation of Congress to this effect.

Mr. E. L. Shafner, of Cleveland, O., presided. The opening day was taken up with addresses of welcome from Gov. Toole and ex-Gov. Richards, of Montana; Gov. Hunt, of Idaho; Mayor Davey, of Butte, and others, and the response and address of President Shafner, the burden of whose remarks was a plea for the creation of the proposed cabinet office of Secretary of Mining.

Several interesting and instructive papers were presented on the subsequent days of the meeting, of which that of Waldemar Lindgren, of the United States Geological Survey, on "The Gold Production of North America; Its Geological Derivation and Probable Future," seems exceptionally valuable.

Prof. Lindgren said that practically the whole of the gold output is derived from fissure veins or from deposits which are closely related to fissure veins. Gold-bearing fissure veins are in most cases accompanied by placers which are only the result of nature's crushing, concentrating and refining; and these placers may be of different ages according to the date of formation of the vein. Fissure veins are formed chiefly by ascending hot water; from which we conclude that gold has been brought up from lower levels of the earth's crust.

The conditions for the formation of auriferous fissure veins seem to be most favorable when extensive eruption of surface lavas and intrusive granites and porphyries have taken place.

As a last chapter in the eruptive activity the hot springs bring up their load of precious metals and deposit them in the fissures in the earth's crust which they follow as the easiest paths.

The gold product of North America, most of which is from the Cordilleran range, is divided among primary veins of pre-Cambrian, Cretaceous and post-Miocene age. In fact from the beginning of the Trias down to the present time great eruptions have followed each other on the Pacific coast, each of which was probably accompanied by gold deposition. In the Rocky Mountain region the igneous rocks began to break out at the close of the Cretaceous, and continued till recently. Even now gold veins are forming in Montana and Nevada.

The oldest gold deposition is, however, the pre-Cambrian of the Appalachian chain, extending from Georgia up to Canada. These are placers and gold-quartz veins with free gold and auriferous sulphides, and much of the gold can usually be extracted by amalgamation. The most important deposits of this age are in the Black Hills of South Dakota.

The Mesozoic age was remarkable for the great eruptions in the Pacific region, the great gold belt of North America. From Lower California to Nome the veins are accompanied by great development of placers.

The deposits of the Cordilleran region are also Mesozoic, and are of gold quartz, sulphides, etc., but not placers.

The tertiary gold veins are usually of post-Miocene age and are found cutting heavy andesite flows, more rarely rhyolite and basalt in regions of intense volcanic activity.

These are called prophylitic veins because of the peculiar alteration of adjoining rocks.

They are often very rich, the word *bonanza* having been coined to express this idea. The gold is so finely distributed as rarely to form rich placers.

These differ from the older formations in having been formed near the surface.

They are most extensively developed in Mexico; but are found in Arizona, New Mexico, California, Nevada, Idaho, Colorado, Utah, and sporadically in some other States, and in southeastern Alaska, but none have been found in British Columbia or Northwest Territory.

The estimates of output from these several formations are:

	Total up to 1900.	1900.
Pre-Cambrian	$144,000,000	$41,000,000
Cretaceous (Pacific)...	1,400,000,000	50,000,000
Cretaceous (Central)...	310,000,000	18,000,000
Tertiary, prophylitic...	537,000,000	18,000,000
	$2,391,000,000	$127,000,000

I. H. Richards, formerly Mayor of Boise, Idaho, and Judge of the Circuit Court, was elected president, and Deadwood, So. Dak., was selected as the place of the next meeting, to be held in September, 1903, the exact date to be hereafter fixed.

A collection of precious stones shown at the Pan-American Exposition by George F. Kunz and purchased by J. Pierpont Morgan has been presented by the latter to the Jardin des Plantes at Paris.

EXCAVATIONS AT CORINTH.

BY PAUL ELSNER, ATHENS.

Of the high mountains which border the Gulf of Corinth none has so beautiful and bold an outline as the inaccessible rocky pyramid of Acro-Corinth, which is crowned by a ruined fortification, at one time of the utmost strategic importance. With an air of command it looks down upon the palaces and towers, on the multitude of temples flooded with a halo of blinding sunlight from the glowing Greek skies, and upon the wealth of monuments, which mark the ancient city, once covering with bewildering glory the enormous "emporium," which, with an area of 20 kilometers, slopes gradually from the foot of the Acropolis to the shore of the sun-bathed sea. After a long epoch of highest culture, beginning about 800 B. C., the fall of Rome brought destruction upon this community, at that time permeated by the spirit of commercialism. For fully a century the weeds grew undisturbed in the streets of the city, which the Roman Consul Lucius Mummius destroyed 146 B. C. Cæsar rebuilt the city and during the height of the Roman Empire it attained a pinnacle of unwonted glory as a cosmopolitan trade center. Mighty waves of Goths and Slavs swept over it and proved destructive to its wealth and position; then under the alternating dominion of the Frank, the Turk and the Venetian this splendid center of culture finally disappeared altogether. Deeper and deeper grew the strata of earth which were layered upon the ruins of the city, stirred only now and again by the plow of the farmer.

To the later period of flourishing culture of the city, in ancient times, only a few pillars of a Doric temple bear pathetic testimony; these pillars are shaded by the high cypresses within the purlieus of the modern village called "Old-Corinth." When the American Archæological Institute in Athens began the large scientific enterprise of the systematic examination of this extensive site of Corinth under the leadership of its director, the eminent archæologist, Dr. Rufus Richardson, in the year 1896, it faced serious difficulties. For even the ancient temple, which in the course of the excavations was entirely exposed and definitely recognized as the Sanctuary of Apollo, furnished no valid clew to the topography of Corinth; and yet the excavations, interrupted only by the Græco-Turkish war of 1897, secured for the fortunate seekers a series of successes.

At the very beginning of the first effort the spade struck the ruins of a theater of the Roman period built immediately above an older Greek theater. It was found at a depth of about 15 or 20 feet and had been surrounded by a laurel grove. Its slumber of centuries duration "in the secret recesses of earth's deeps" had been disturbed only by a number of trenches, which now furnish an intelligent plan of its construction.

Three water-courses were also unearthed; the celebrated spring of flowing water called Peirene, walled up during the Roman period; a second spring disturbed by an earthquake, which lies between the theater and the Temple of Apollo, at the foot of the hill crowned by the latter; and finally the old city fountain of Corinth. Time has dealt so kindly with this venerable structure, a fountain surmounted by a Poseidon with dolphins at his feet, that it is the best preserved type of any Greek water-course hitherto excavated. The fountain was inclosed in the time of the Romans by a balustrade, 30 meters in length, shimmering in red, blue and yellow colors. The sheen of the wealth of color is as resplendent to-day as it was in the olden days, when the women and maids of Corinth gracefully bore their earthen jars to the melodious fountain to be filled. This resplendent balustrade is a most instructive example of the polychrome process used in Greek structures.

Further excavations of a part of a marble staircase which led from the propyla downward to the wharves and to the Agora (market-place) indicate clearly the contours of the topography of Corinth.

Furthermore, the spade disclosed by successive steps in a westerly direction all the structural appurtenances of the propylon, so that this triumphal arch formerly frowning down upon the city, could now be easily reconstructed. There are to be considered in this connection two colossal figures of Phrygians, dating back to the first or second century of the Christian era. Connected with the right and left pillar of the propylon, they bore the Corinthian capitals and the architrave of the triumphal arch, which have also been found. The features of the one colossal figure, 2,000 years old (found inverted in the soil), were fully preserved; in the other, the nose, formed of a separate piece, had been inserted. In the neighborhood of their bases, which are ornamented in relief, there were found two female heads, more than life size, whose imposing beauty materially heightened the majestic impression of the propylon. The last finds of relief-representations of Helios and Selene furnish the last link in the series of structural parts of the propylon.

Of the rich statuary discovered, only the following can be mentioned here; a life-size head of Ariadne, a relief of two almost life-size dancing girls, with classically beautiful drapery of the garments, dating back to the Roman period, and a small Greek votive-tablet, representing seven gracefully grouped figures artistically finished.

TWO FEMALE HEADS, OVER LIFE-SIZE, FOUND NEAR THE PROPYLON.

Science has been presented with valuable additions by these relics of vanished ages, for which it is indebted to the American Archæological Institute.—Translated for the SCIENTIFIC AMERICAN from the Illustrirte Zeitung.

COLOSSAL FIGURE BEARING THE ARCH OF THE PROPYLON.

RELIEF OF HELIOS AND SELENE.

Another Floating Dock.

Another huge floating dock was recently launched from the shipyard of Messrs. Swan & Hunter, at Wallsend-on-Tyne, England. Although similar in character to the floating dock lately built by the same firm for the British Naval Station at Bermuda, it is much smaller—4,500 tons maximum lifting capacity—and is intended for commercial rather than naval purposes. It has been constructed for the port of Durban, Natal. The necessity for a structure of this type was proved during the South African war, since this port has no dockyard facilities, though an extensive scheme of providing adequate dock accommodation and port reorganization, including the construction of graving docks of a large size, is in progress. But the superior advantages of the floating pontoon dock, in lieu of the usual type of graving dock for commercial purposes is becoming more and more emphasized every year. The designs for this floating dock were carried out by the engineers, Clark and Standfield, London. The extreme length of the dock is 365 feet, width 87 feet. The distance between the guard timbers on the side walls is 61 feet, so that the dock can accommodate vessels up to 60 feet beam, while, when still retaining a freeboard of 4 feet, it can take a vessel drawing 18 feet over keel blocks 4 feet high. Its dead weight lifting capacity is 4,500 tons. The dock consists of three pontoons and two side walls, and any of the pontoons can, when required, be removed and lifted by the dock itself, thus making it self-docking in all its parts.

The machinery of the dock is contained in the upper portion of the side walls, and consists of two separate but identical installations. Each installation comprises a boiler and two pumps, each pump driven by its own separate engine; and the piping arrangements of the dock are so arranged that either pump can empty the whole of the compartments on its side of the dock.

In addition to this there is a communication through the central bulkhead across the dock, so that, in case of any breakdown it would still be possible to lift the dock by the engines of one side alone. The boilers are of the ordinary return tube marine type 10 feet long by 9 feet 6 inches diameter. The engines are of the horizontal compound tandem type, placed on either side and driven directly onto the vertical spindle of the centrifugal pumps, which are placed right down at the bottom of the dock, directly on the top of the main drain of the pumping system, the weight of the shafts and the propellers being taken on ball bearings at the engine deck.

The dock itself is divided into 40 water-tight compartments, each of which has a separate communicating pipe, each pipe being provided with its separate valve. All these distributing pipes are collected together into the main drain on which pumps are seated and the discharge and inlets into this main drain are governed by large screwdown valves and by automatic flap valves outside the dock. The different compartments are all worked by means of bell cranks and rods and levers from the valve house, which is placed centrally on each wall, whence direct communication can be made to the engines and the inlet and outlet valves, so that the valveman standing in his house has complete control over the whole of his section of the dock. In addition to the ordinary requirements of a dock, the present one is provided with a small but very complete electric light installation, which will enable work to be carried out on ships through all the hours of both night and day. The direct-current system is utilized at a tension of 110 volts, the electric cables being all contained in steel tubes to prevent being injured with the exception of the cable which crosses the dock, which is drawn into lead and suitably armored.

Fish Flour in Norway.

A great deal is done in Norway to improve and preserve the provisions produced in the country and to procure a market for them abroad. The fisheries represent one of Norway's chief industries, and quantities of fish are sold at very low rates, particularly during summer. One way in which these are utilized is by means of an invention which quickly dries and pulverizes the flesh of fresh fish. The resulting product, called fish flour, is easy to transport from one place to another and has great nutritive value. A new and profitable branch of industry might be established in America, by utilizing fish in this way.

The Growth of American Parks.

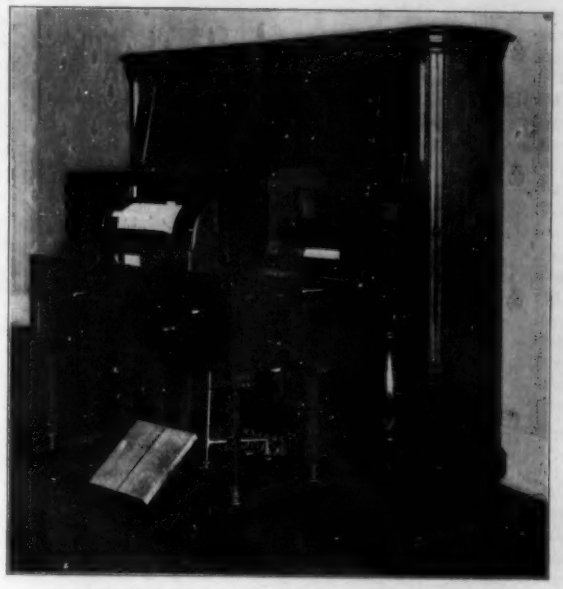
The American Park and Outdoor Art Association has compiled some interesting statistics which show what great strides have been made in improving the appearance of our large cities. Fifty years ago no municipality in the United States had reserved a single acre of land for park purposes. Last year there were in cities of more than fifty thousand population 2,360 parks and squares with a total area of 59,717 acres, the valuation being $531,571,947. In the entire United States there are about 75,000 acres of park land, for the improvement and maintenance of which at least $11,000,000 are spent annually.

THE SEMI-AUTOMATIC PIANO-PLAYER.

The advance of civilization has brought with it a more numerous and critical music-loving public. At the same time, in the press of modern business activity, the man of musical tastes does not often have the opportunity or necessary time for mastering a musical instrument. Again, the beginner's appreciation of the art is often so advanced that his discordant and halting efforts are extremely painful to his sensitive ear. In fact, he must suppress his loftiest inspirations by a most mechanical system of scales and finger exercises before he can become even a fair player on such an instrument as the piano. However, necessity is the mother of invention, and the modern semi-automatic players have now come to the rescue by affording us all a ready means of playing the most difficult music with our own individual coloring and expression—this too without the necessity of any tedious preliminary practice. Such instruments are well known and already have their accepted place in the musical world. The principles on which wind instruments are automatically played are quite familiar to the general public, but we venture to say that few understand the workings of the semi-automatic piano-player, and we therefore take pleasure in acquainting our readers with the construction and important features of the Simplex piano-player which is illustrated herewith. A number of important patents on this piano-player have been granted to Mr. Theodore P. Brown, of Worcester, Mass., who is now manufacturing the instrument.

The Simplex piano-player is characterized by its simplicity of construction. One of our views shows the instrument in playing position against the piano, its striker rods being in position over the keyboard and its pedal lever connected to the loud or open pedal of the piano. The music rolls used are identically the same as those used on self-playing organs and the like, because the Simplex is a pneumatically-operated instrument. The music roll consists of a long sheet of paper provided with a series of perforations of such dimensions and locations as to co-operate with the mechanism of the player to produce the desired music. The sheet is passed over what is termed a tracker-board, which is shown at *B* in the illustrations. The tracker-board forms a mouthpiece for a series of tubes which connect with their respective pneumatics, *M*, to which the striker rods are secured. Each pneumatic, under spring tension, holds its respective striker-rod in raised position, but it is deflated and the rod forced downward whenever the vacuum of its respective tube is destroyed. An exhaust mechanism operates to maintain a vacuum in each tube at all times except when a perforation of the music-sheet, while passing over the mouth of the tube, admits air therein. The exhaust is maintained by a pair of treadles which operate the bellows, 6, shown in the rear view of the mechanism. These bellows suck the air from a wind-box, *A*, and a secondary bellows, 5, the latter serving to insure a steady suction and overbalance any irregularities in the operation of the bellows, 6.

A clear idea of the pneumatic operations may be had by a glance at the diagram, which shows a section through two of the pneumatics and their accessory parts. The music roll, *X*, is mounted on bearings at *S*, and the music sheet passes over the tracker-board, *B*, to the winding roll, *T*. The tubes, *C*, which have openings in the tracker-board, lead down to their respective primary chambers, 7, from which they are separated by flexible diaphragms. The air in these tubes is sucked into the wind-box, *A*, through small openings in the ventilating disks, *D*. A constant exhaust is also maintained in the primary chamber, 7, and the tubes, *G*, with which they connect. Normally the diaphragms assume the positions shown, and the



THE SIMPLEX PIANO-PLAYER IN PLAYING POSITION.

poppet valves, *E*, are forced downward by gravity and held in this position by the outside air pressure. Thus the tubes, *G*, are closed to communication with the outside atmosphere, but are open to communication with their respective chambers, 7. However, when air is

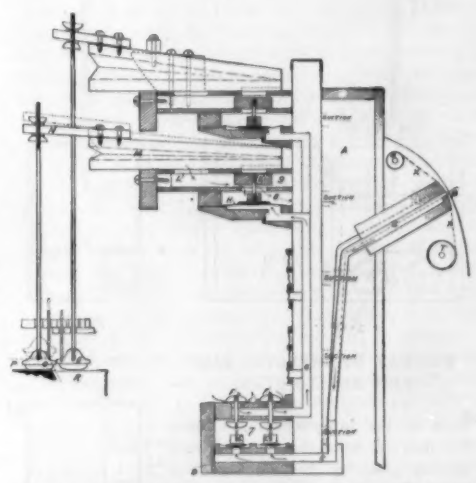


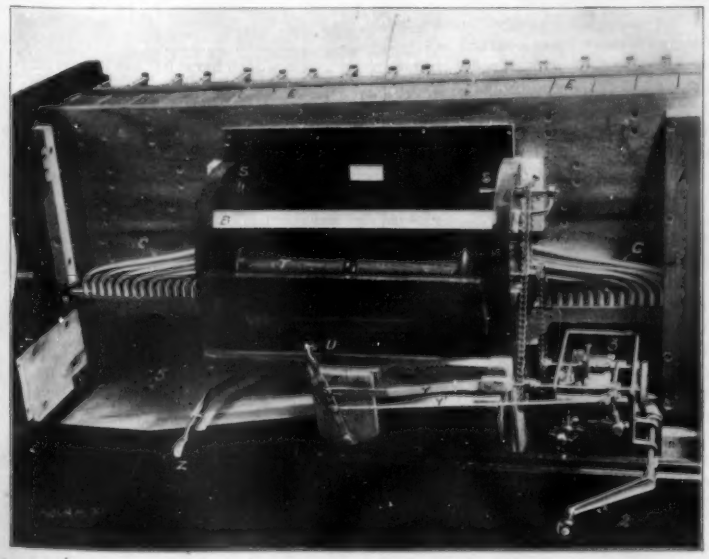
DIAGRAM SHOWING PNEUMATIC CONNECTION BETWEEN MUSIC ROLL AND KEYBOARD.

admitted through the tracker-board to tube, *C*, it flexes the diaphragms upward and thus raises the poppet valves which close the exhaust ports of tube, *G*, and admit air through the inlet port under disks, *F*. The tube, *G*, bears the same relation to the secondary chamber, 8, that tube, *C*, does to chamber, 7, so that when air is admitted therein, diaphragm, *H*, is flexed upward and the poppet valve, *K*, is raised, closing the inlet port of chamber, 9, and opening the exhaust port into chamber, 8. The pneumatic, *M*, is connected by port, *L*, with chamber, 9, and the secondary chamber, 8, is connected with wind-box, *A*, so that when valve, *K*, is raised, the pneumatic *M*, is suddenly deflated and the striker rod secured to the upper board is depressed and strikes the piano-key immediately thereunder. A padded button, *O*, is secured to the lower end of each striker-rod, so that no clicking sound is heard as the keys are struck. As long as any tracker-board opening is uncovered, its corresponding striker-rod will remain depressed, but as soon as it is closed, the diaphragm of the lower chamber, 7, and the valve, *E*, will drop to their normal positions, opening the exhaust port of tube, *G*, and closing its inlet port. The same thing takes place in chamber, 8; the diaphragm, *H*, and valve, *K*, drop down, closing the exhaust port of chamber, 9, and permitting air to flow into the pneumatic, *M*.

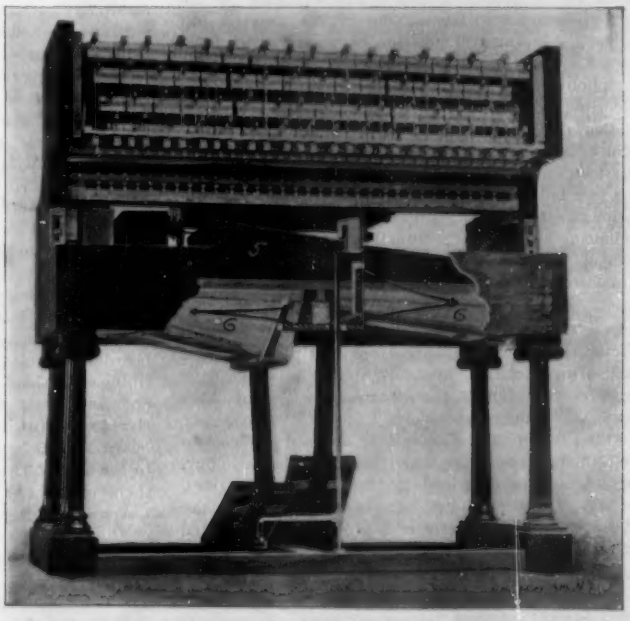
The internal and external air pressure being thus balanced, the pneumatic is free to rise under spring tension and release the finger-key of the piano. It will be noticed in the diagram and also in the rear view of the machine that the pneumatics are located in four tiers. This arrangement is necessitated by the narrowness of the piano keys, which would require the use of very narrow pneumatics where they are all arranged in a single row.

An important feature of the Simplex player, and one which distinguishes it from other instruments, is the mechanism which draws the music sheet over the tracker-board. This mechanism, which is shown at 3 in the front detailed view, is entirely independent of the rest of the machine, being operated by a heavy clock spring which is wound up by a few turns of crank, 2. The action of the motor is completely governed by the lever, *U*, to which two connections, *Y* and *Y'*, are secured. The connecting rod, *Y'*, regulates the speed of the motor. This is effected by means of a bell-crank, of which one arm is pivoted to the rod, *Y'*, and the other has frictional engagement with a disk. This disk is raised and lowered according to the speed of the motor by means of a pair of balls which are centrifugally actuated. By this arrangement it will be seen that the bell-crank arm is continually held in frictional contact with this disk, and that the speed of the motor can be accelerated or retarded at any time by shifting the lever, *U*, to decrease or increase the friction. The winding roll, *T*, is connected by chain and sprocket to the winding wheel of the motor, and the rewinding pin, *S*, is similarly connected to an idler which may be thrown into operation by the connection, *Y*, whenever it is desired to rewind the music sheet. The lever, *U*, has a pin-and-slot engagement with the connection, *Y*, so that the latter will not be shifted until the highest speed of the motor has been attained, when by moving the lever, *U*, to the extreme right two clutches are operated; one, connecting the winding sprocket with the power shaft, is disengaged, and the other, connecting the rewinder, is thrown into operation. The rewinder gearing is adapted to give a very rapid rotation to the music roll, so that very little time is consumed in re-rolling the music at the end of a piece.

With the foregoing details in mind we can clearly



MUSIC ROLL, WINDING MOTOR AND TUBES CONNECTING WITH THE STRIKING MECHANISM.



REAR VIEW BROKEN AWAY TO SHOW THE MAIN BELLOWS AND THE SECONDARY BELLOWS FOR OPERATING THE KEY RODS.

understand the method of operating the machine. The player is rolled up against the piano and properly positioned with its striker levers over the keyboard and the pedal lever set. The desired roll of music is now secured between the bearings, *S S*, and the end of the music sheet is passed over the tracker-board, *B*, and secured to a hook on the roller, *T*. The motor having been wound up, a slight movement of the key-lever, *U*, starts the mechanism and slowly draws the music over the tracker-board. The desired speed is now obtained by shifting the speed-lever. For the benefit of the beginner a celluloid strip is provided behind the lever, *U*, on which eight different speeds are registered and indicated by musical terms ranging from *largo* to *presto*. On the music roll the required speeds are printed, and by shifting the speed-lever to the positions called for, the proper tempo will be obtained. Open pedal effects are had by the lever, *Z*, which is operated with the left hand. The *piano* and *forte* effects are controlled by the operation of the pedals. The greater the suction in the wind box, *A*, the more rapid will be the action of the pneumatics and consequently the more vigorously will the keys be struck; a quick thrust of the treadle gives an immediate response. On the other hand, a slow movement of the pedals results in a sluggish action of the pneumatics, which produces a *pianissimo* effect. Directions are printed on the music roll to guide the beginner in these different shades of expression, but if he has a musical feeling, these directions are soon disregarded by the performer, and his own time and expression are unconsciously embodied in the music. Especially is this so with regard to the loud and soft effects, for even the most unmusical among us know how difficult it is to keep our feet still when listening to a thrilling march, and how listlessly we move when a dreamy waltz is played. This in crude form is what musicians term "expression" or "feeling." The Simplex piano-player makes use of this peculiarity, and employs the natural impulses of a performer to express his musical feeling.

We can therefore appreciate the importance of using an independent spring-actuated winding motor; and to this in large measure is attributed the success of the Simplex player; for by using a spring motor in place of the usual wind motor, the bellows may be made sensitive to sudden changes in force, thereby giving opportunity to express the music and phrase it as one would if playing manually. Players using wind motors are confined to a given tension of the bellows at all times; otherwise, the motor would change in speed as the bellows change in tension, the result being that they must obtain their expression through mechanical levers and resistance.

The Current Supplement.

The current SUPPLEMENT, No. 1394, is a number remarkable for the diversity of the subjects treated. M. Jacques Boyer has specially prepared for this SUPPLEMENT a review of the methods of making natural and artificial perfumes—a subject which has received but too little attention from the technical press. A paper on the chemistry of the protection of steel against rust and fire by concrete is one of exceptional value. Automobilists will no doubt read with interest a description of the Holden motor cycle. The very full illustrations and the exhaustive explanation of the various parts, give to the article a certain thoroughness which is not always characteristic of descriptions of motor carriages. "The Roman Galleys of Lake Nemi" is the title of an archæological article distinguished for its scholarliness of treatment. One of the greatest improvements in the transmission of messages by long-distance submarine cables since the introduction of the siphon recorder is the automatic relay translating device invented by Mr. S. G. Brown. The paper which Mr. Brown read before the Institution of Electrical Engineers, describing his invention, is reproduced in full. Particular pains have been taken to illustrate the paper adequately. Prof. Conklin's paper on the relation of the psychic life to the nervous system is concluded. Mr. Otto F. Hunziker begins a valuable series of papers entitled "A Review of the Existing Methods for Cultivating Anærobic Bacteria."

The Summer Complaint Bacillus.

Victor H. Bassett, of Johns Hopkins University, and Charles Duval, of the University of Pennsylvania, have discovered the germ of the disease which is popularly known as "summer complaint." After the death of his grandson, John D. Rockefeller donated $200,000 to found an institute of medical research in bacteriology. With the means provided by the Rockefeller fund, Mr. Bassett and Mr. Duval have been enabled to make their discovery. The germ is found to be the same as that which causes acute dysentery in adults.

Wireless Telegraphy Between Italy and England.

The Marconi Wireless Telegraph Company announces that it has received perfect messages at Poldhu, Cornwall, from Gibraltar and Spezia.

AN IMPROVED DRYING OVEN.

BY EDMUND S. SMITH.

For the benefit of chemists and others who desire a more convenient apparatus than the gas-heated air-baths commonly in use for drying precipitates, coal and coke samples, clays or any other substances requiring only a moderate degree of heat, a simple and easily constructed oven is described below.

The heating agent employed is the ordinary incandescent lamp, thus eliminating the troublesome "scaling" and "burning" of the common gas-heated oven bottom. Nor are cleanliness and durability its only advantages. The temperature obtained is practically constant, and there is no danger from overheating, a fault not infrequently found in direct-heated ovens when the gas pressure fluctuates. In the bath here described two 110-volt, 20-candle power lamps are employed. One lamp will heat the oven to 70 deg. C. (158 deg. Fahr.), while two lamps yield a temperature of 110 deg. C. (230 deg Fahr.). By the use of other sized lamps or by increasing their number, it is obvious that quite a range of temperature may readily be obtained.

In the oven made by the author, the box was 9½ inches high, 7½ in width and 6½ inches deep, cut and shaped in one piece from No. 28 galvanized iron and lined with asbestos. (See Fig. 1.) The edges of the iron on the front side are bent over for a distance of ⅝ of an inch, making a wide seat for the door. At the back of the bottom is a jog 3 inches high and 2 inches deep to carry the lamp sockets, as shown in Fig. 2, which is a side elevation of the box with the wall removed. The back wall is protected at *a* by soldering a strip of galvanized iron to the wall. This strip extends the full width of the box and is also soldered to the side walls, hiding the jog from all points of view except the bottom, which is shown in Figure 3. This strip is drilled with two ⅝-inch holes to carry the outer

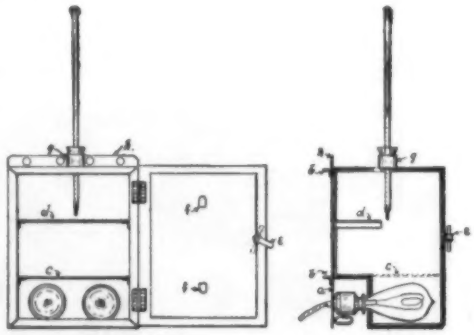


Fig. 1. Fig. 2.

DIAGRAM OF IMPROVED ELECTRIC DRYING OVEN.

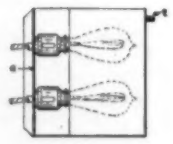


Fig. 3.

ends of the lamp-sockets, while the inner ends of the sockets are held in place by the lamps passed through the holes in the front wall of the jog, of just sufficient size to hold them securely. No rubber fittings of the socket must pass within the box-lining, since the heat within would soften them. The lamp keys are accessible from the bottom only.

As the bath is designed to hang upon a wall, the small angle-irons soldered to the back at *b b* furnish clearance for the lamp connections and at the same time afford protection against overheating the supporting room-wall.

The shelf, *c*, made of perforated sheet iron or coarse wire screen, is supported by small tin or galvanized iron angles soldered to the side walls. The upper shelf, *d*, is but 3½ or 4 inches wide and is drilled and slotted to hold funnels containing precipitates, etc.

The door is hung by small brass hinges soldered in place. (See Fig. 1.) The latch, *e*, carried by the rotating handle engages the door-seat when closed, tightly locking it.

When the box is completed it is lined throughout with asbestos board ¼ inch thick. If proper care be used in cutting, no rivets will be necessary, as the board is sufficiently stiff to support itself. The side-linings will hold the top in place. The inside of the door is covered with asbestos board, of just sufficient size to fill the opening inside the door seat. This board is held in place by two small clips, *f f*, soldered to the door. These pass through the asbestos and are then bent over to secure it firmly.

A small tube, *g*, soldered around a hole in the center of the top holds a cork carrying the thermometer, as in other drying-ovens. The box is hung from the drilled strip, *h*.

If a higher temperature than 110 deg. C. is desired, it is suggested that ¼-inch asbestos board be used for lining, as the loss of heat by conduction with ⅛-inch board is quite appreciable.

A Single-Phase Railway.

A contract has recently been awarded for the equipment of an important interurban road with alternating current apparatus throughout. The road in question is the Washington, Baltimore & Annapolis Electric Railway, which is to operate a line from Washington to Baltimore, about 40 miles in length, with a branch to Annapolis, 15 miles in length.

This contract marks a great step in advance that has long been awaited by engineers, both in this country and in Europe. In the ordinary method of operating street railways direct current is fed to the trolley line for the car motors. For city lines and densely populated districts, the current is often generated as direct current, but for long-distance interurban roads this would involve a cost of copper conductors entirely prohibitive. To meet the latter objection a system has been used thus far in this country involving the generation of alternating currents at high pressures of from 10,000 to 30,000 volts and the transmission of the same to substations, where by means of transformers and rotary converters the current is supplied to the trolley wire as direct current at the usual railway voltage from 500 to 650 volts. The rotary converter substation, however, has always been an undesirable feature, chiefly on account of the cost of the apparatus and building and the attendance required. The plans that have been proposed to do away with this feature are numerous, but before this, none have appealed to practical American street railway engineers.

In Europe the polyphase induction motor has been used to some extent, but it implies the use of two or three overhead wires, and, moreover, the characteristics of the induction motor in regard to starting and average efficiency in railway service are said to be not of the best. Other systems which have been proposed involve the use of single-phase motors upon the cars driving generators which in turn supply power to the motors on the axles. However, this involves the placing of a substation upon the car itself, and so cannot be considered a great improvement over the ordinary alternating current-direct current system.

For the road which is now being constructed between Washington and Baltimore, single-phase, alternating current will be generated in a main power house, located at Hyattsville, by three 1,500-kilowatt, single-phase, Westinghouse generators, delivering current at 15,000 volts and drived by cross-compound, Hamilton-Corliss engines. This station is of more than average size and is in no sense experimental. The power house will be built of brick with stone and concrete foundations, and will contain in addition two 125-volt direct-current generators to be used as exciters for the alternators and a large switchboard with electrically-operated oil switches, circuit-breakers, lightning arresters, etc. Current will be distributed from the power house at 15,000 volts to transformer stations located at suitable intervals along the line. These transformer stations will contain only stationary transformers with the necessary switches and fuses, but no moving machinery, and will, therefore, not require the presence of an attendant. From these stations current will be fed to the single trolley wire at 1,000 volts. The pressure of 1,000 volts which has been adopted for the trolley wire is not a necessary part of the system, as a much higher voltage could have been used if it had been deemed advisable by the engineers of the road.

The cars will probably be sixty feet in length and weigh about fifty tons each. They will be supplied with Master Car Builders' trucks designed for high speed. The track is laid with 80-pound rails, and it is expected that the distance of thirty-one miles will be made in forty-five minutes, including stops. The cars are to be equipped with four motors, each of 100 horse power. The designers believe a normal speed of forty to forty-five miles can be attained, and a speed of sixty miles reached when necessary. The motor, which is the novel part of the equipment and the key to the entire system, is a variable-speed motor having characteristics adapted to railway service and in all respects equal to the present direct-current railway motor. It has been developed and tested in severe service during the last few years by the Westinghouse Electric and Manufacturing Company, under the supervision of Mr. B. G. Lamme, assistant chief engineer.

It is to be remarked that this latest development in electric railroading follows in a path already traced by electric lighting. The first electric lighting systems employed direct current at low voltage, but as the area to be supplied increased, this involved an increased cost of copper cables. To meet the difficulty, alternating-current distribution at high voltage was adopted, with rotary converter substations, to enable the current to be distributed on the existing mains as direct current. However, most electric power plants now being installed distribute low-voltage alternating current directly to the lamps and motors, thus avoiding the expensive rotary-converter substations.

The results obtained on the first trials of this line will be awaited with interest.

Correspondence.

An Anticipation of Marconi's Antenna.

To the Editor of the SCIENTIFIC AMERICAN:

I have just read in the SCIENTIFIC AMERICAN of August 9 your article on the new station at Cape Breton, erected by Marconi, of whom I am a sincere admirer. The particular form of antenna employed struck me. Indeed, I may claim to be the inventor (for I was the first to employ it) of an inverted cone or pyramid of wires to be used as an antenna in wireless telegraphy. I used antenna at the Congress of Brussels in making my experiments between Brussels and Anvers with my automatic relay (see SCIENTIFIC AMERICAN, March 8, 1902). At various times I have explained the merits of this antenna, which has been adopted by M. Ducretet, of Paris, and described and illustrated in the London Electrical Review of May 22, June 7 and 28 and July 12, 1901.

I have not the least intention of detracting anything from Marconi, the importance of whose work certain critics have sought to belittle. I desire simply to state that in 1900 I invented an antenna which worked effectively, and which seems to be the same as that employed by Marconi in his transatlantic experiments.

Brussels, August 18, 1902. EMILE GUARINI.

An Interesting Chess Set.

BY WILLIAM H. HALE, PH.D.

Gold mining, while it so much overshadows everything else at Nome, Alaska, and thereabout, is not the only industry. The tusks of the walrus, and those of the extinct mammoth, some of which are still found from time to time, are etched and carved by the Eskimo, and to a less extent by some white artists.

The favorite work is the manufacture of cribbage boards from walrus tusks. During my stay at Nome, however, an Eskimo brought in a mammoth tusk with etchings by a native artist. I also saw a very cleverly carved set of chessmen, made from ivory of the mammoth by Max Roth.

The pieces are carved to represent in the human figures different nationalities, in the knights various animals, and in the castles orders of architecture. The white pieces represent civilization, the black ones —indicated only by a red base—represent barbarism or lack of civilization.

The white king and queen are medieval monarchs, clad in appropriate costume, the king wearing the chain with pendent lamb, insignia of the order of the Golden Fleece, and both figures wearing ermine.

The black king is a Roman emperor with toga, laurel wreath and coronet; the queen an American Indian, with feather crown, braided hair, earrings, necklace and blanket.

The white castles are Ionic and Corinthian columns; the black ones are Doric and Gothic, the Gothic consisting of four small columns joined in one, and surmounted by a wreath of ivy. Each of the castles has a globe on top.

The white bishops are an Episcopal prelate wearing a cross above his head and another on his breast; and a Jewish rabbi, whose miter has a front-plate inscribed with the sacred name Jehovah. His breast plate is the Urim and Thummim, and he is girt with the sacerdotal girdle. The black bishops are one of the Greek church wearing on his miter the emblematic cross of that church which has two cross pieces, and on his breast the crucifix; and a Roman Catholic bishop of the Italian type, with curled hair and simple costume, having a plain cross on his breast.

The white knights are the horse, as in ordinary chess sets, and the dog, domesticated animals, and both utilized in Alaska for the same service; the black ones are wild animals, the bear and the lion.

The white pawns are an American and an Englishman, each wearing a high hat, the Scotchman with a feather in his cap, the Irishman with a slouch hat, a Jew wearing a high hat, a Hungarian with a feather in one side of his slouch hat and pipe in the other, a Spaniard with slouch hat and earrings and a Japanese with a straw hat and an enormously elongated mustache.

The black pawns represent four continents and are an Amerind (to adopt the new nomenclature of anthropologists) with feather headdress, and an Eskimo of Alaskan type with mustache and fur hood for America; a Frenchman with felt hat and beard trimmed as Napoleon, and a German peasant for Europe; a turbaned Turk with crescent on his brow, a Persian with fez and a Chinaman with long queue on his back for Asia; and a thick-lipped negro for Africa.

The Pennsylvania Railroad Company has ordered from the Baldwin Works 250 high-class freight locomotives, worth $3,250,000, to be delivered within the first six months of 1903. This is probably the largest order ever given by a railway company to a single firm. The entire number of locomotives to be ordered from various manufacturers will probably be increased to 400.

Engineering Notes.

A comprehensive estimate of the amount of silt removed from the estuary of the River Mersey at Liverpool to maintain an open channel for the large Atlantic liners is afforded by the last annual report of the Mersey Dock Board Engineers, which shows that 28,000,000 tons of sand have been removed by dredging from the Mersey River, and 35,000,000 tons from the estuary channels since the operations were commenced, ten years ago. During the past year 27,000 cubic yards of material were dredged in the vicinity of the new river entrances to the deep-water docks. A much larger amount of general engineering work has been carried out in the docks during 1901 than during any previous year, the expenditure for the twelve months being nearly $7,500,000.

The government of New South Wales has received tenders for the new huge bridge that has been designed to span the harbor of Sydney, and which when completed will rank as one of the finest bridges in the world. The structure is to be 3,000 feet in length, not including approaches, and the latter are not considered in the estimates for the bridge itself. The tenders for the contract, which were as follows, are remarkable for their variation:

Joseph Bentley, Leeds, England, $38,602,390; Alex. Findlay & Co., Motherwell, Scotland, three tenders ranging from $7,619,185 to $8,309,330; William Arrol & Co. and Head Wrightson & Co. $8,553,440; the Cleveland Bridge and Engineering Company, Darlington, England, $8,970,590; Compagnie de Fives, Lille, France, $15,253,750; E. & C. Bridge Company England, three tenders ranging from $8,330,000 to $9,715,375; J. Stewart & Co., Sydney, six tenders ranging from $5,564,295 to $9,665,970; Gilbert Weaver, Sydney, $8,876,035; Henning & Hildebrand, New York, $10,000,000.

The Census Bureau has issued a report on the manufacture of locomotives, which shows a capital of $40,813,793 invested in the twenty-eight locomotive works reporting for the United States. The value of the products is returned as $35,209,048, to produce which involved an outlay of $10,899,614 for wages, $1,369,341 for miscellaneous expenses, and $20,174,395 for materials used. At the twenty-eight establishments 2,774 locomotives of all classes were built, with an aggregate value of $27,121,063, compared with 2,409 locomotives, valued at $19,752,465, built in nineteen establishments in 1890. In addition, 272 locomotives, valued at $3,276,393, were constructed at twenty-six railroad shops, making a total of 3,046 locomotives, valued at $30,397,456, built in fifty-four establishments during the census year 1900. There was a considerable increase in the value of locomotives during the ten years. The 2,409 locomotives built in 1890 had an average value of $8,199, while the 2,774 built at locomotive works in 1900 averaged $9,777 in value, an increase of $1,578, or 19.2 per cent, due in part to changes in size and construction. The increase in the number of locomotives built in 1900, as compared with 1890, was largely due to the foreign demand, the number exported in 1900 being 525, compared with 161 in 1890, an increase of 364. Pennsylvania led in the manufacture of 1900, with 48.2 per cent of the total value of products. In 1890 that State also led in value of products, with 44.6 per cent of the total. New York was second, with 27 per cent. New Jersey was third.

The utilization of petroleum for fuel and other commercial purposes is being more widely adopted, comparatively speaking, in the little European state of Roumania than in many other larger and more important countries. Nearly all the sugar mills, distilleries, gas works, hospitals and manufactories in Roumania now use petroleum refuse as fuel, as well as the state railway, upon which it is employed largely for the locomotives. During the last two years the price of British coal, which was formerly almost exclusively used in the manufactories, has mounted to about $10 per ton. Considering that the heating effect of petroleum residue is about one and a half times that of coal, and taking the price of coal at $10 per ton, the comparative value of petroleum residue is equivalent to $15 a ton. The average price of residuum, however, is about $8, and crude petroleum $7 per ton. It is proposed to hold a Petroleum Congress at Bucharest in 1903. Before this congress will be laid geological maps of Roumania, showing the petroliferous zones, worked and unworked; maps showing the salt, lignite, coal and quarries existing in the country; tables explaining the growth and development of the petroleum industry, a series of geological sections of the most important works and soundings, analyses of the chemical and industrial properties of the petroleum, photographs of the chief refineries and workshops, a series of geological sections of the valleys, plans of injectors in service for the use of petroleum as a combustible as employed by the Roumanian state railways and navigation societies, and a map showing the geographical position of Roumania in regard to other countries, buyers of petroleum, the means and cost of transport, besides other matters of importance bearing on the subject of petroleum.

Electrical Notes.

It has been announced that Ernest Ruhmer, of Berlin, has succeeded in carrying on a telephonic conversation, the impulses having been transmitted along a ray of light. The facility of a light beam to carry sound was first discovered by Alexander Graham Bell, the inventor of the telephone, while he was at work on some features of the telephone, over twenty years ago. He abandoned experiments on this line, as the discovery seemed to have little or no practical value.

A power plant is now in operation utilizing the water from the Cauvery Falls of India. The current is being carried ninety miles away, and there made use of in gold mining. The difficulties attending the erection of this plant and the transmission line were enormous, nearly all of the material being conveyed to the point by trained elephants or on the backs of mules and bulls. A path had to be cut through a jungle, infested by fierce animals, serpents and dangerous insects. One of the most serious difficulties to overcome, notwithstanding these terrors, was the superstitions of the natives, who regarded the river as sacred, and with great difficulty could be induced to work on the project.

The electro-chemical industry of this country has grown up since 1890. But its growth has been rapid in that decade, indeed, so rapid as to make serious inroads on the older processes. As an example of this movement may be cited the electric production of calcium bisulphid. The substance is made by one of the most ingenious chemical applications of electricity. The process in question is the invention of Edward R. Taylor, and was put in operation in 1900. The process is continuous, the current being regulated either by the amount of conductive carbon introduced into the furnace or by reducing the working surface of the electrodes by partially submerging them in the molten sulphur.

Prof. M. I. Pupin, of Columbia University, in a paper on "The Law of Magnetic Hysteresis" read at a recent meeting of the American Philosophical Society, presented an account of a mathematical and experimental research upon the magnetic properties of iron which resulted in the discovery of a new law in magnetism. This law can be stated as follows: "The heat generated per unit volume of iron during a cycle of magnetization is proportional to the cube of magnetic intensity." This law holds true within the first of the three well-known intervals of magnetization. It was discovered by determining accurately the resistance of the magnetizing helix, employing vibratory magnetizing forces of about 1,000 periods per second, and then separating the various components of this resistance by means of mathematical analysis. This investigation is an extension of the researches of Prof. Ewing, of Cambridge University, England, and of Lord Rayleigh, employing a new and very much more sensitive method. Its results have a very important practical bearing on the manufacture of inductance coils. From its purely scientific aspect the new law derives its principal interest from the fact that it will materially assist in the formulation of the physical theory of magnetism.

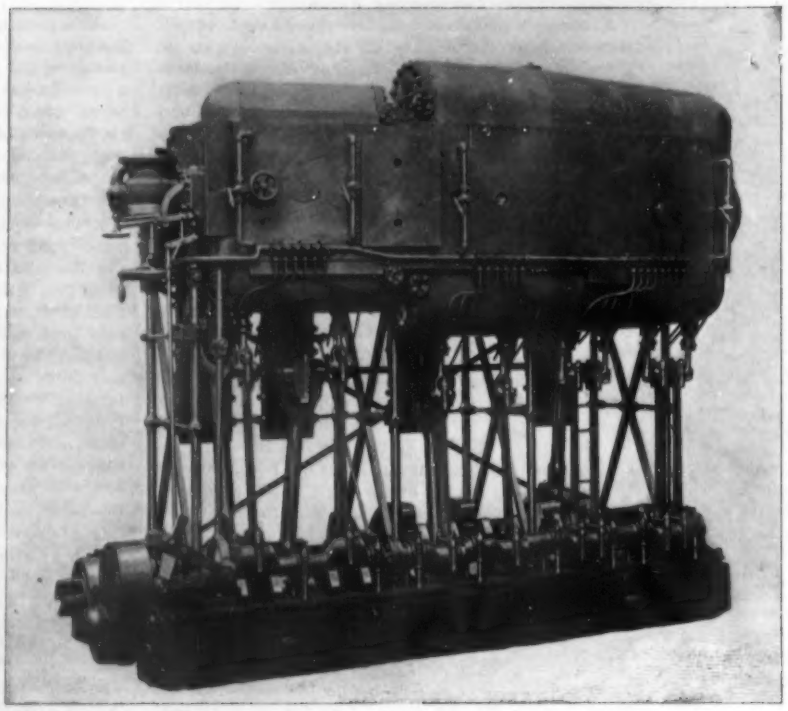
Discussing European practice in electric traction in the Street Railway Journal, Mr. H. Veilgath says the most notable departure in European practice from American standards is in the use of the bow instead of the trolley wheel. During the last few years the former has grown steadily in favor, although it is not as generally used as the wheel. It is claimed on behalf of the bow trolley that it eliminates all danger of loss of contact, and that there is no necessity for reversing the bow when the direction of the car is changed. Greater contact surface is afforded and much easier spans in curves are secured. The bow, while improving the appearance of the overhead construction, greatly decreases the cost of maintenance. In order to allow the bow to turn over automatically when the car changes its direction, the distance between the rail and the trolley line ought to be as constant as possible. European engineers who favor this form of construction contend that there is no difficulty in doing this, and even many users of the trolley wheel favor the bow for higher speeds and heavier traffic where heavy currents are used. The writer states that many changes and improvements have been made in the bow in recent years, and in its present form it is favorably considered by the engineers of many systems who, however, adopted the trolley wheel when the bow was not in so efficient a state as it is at the present time. Further discussing European practice, the writer notes that the slotted conduit with complete metallic circuit has been found satisfactory, but it is only used in large cities where the traffic is very dense, where the difference in cost between it and a modern first-class trolley construction is very slight, and where the undertaking may be expected to pay good interest. On the Continent it has been installed only where the trolley has been forbidden. Thus, the system is extensively used in Berlin, Brussels, Paris and Budapest, and on a smaller scale in a few other cities.

THE STEAM YACHT "ARROW"—THE FASTEST BOAT IN THE WORLD.

On the eastern shore of the Hudson River, near Ardsley and adjacent to the right of way of the New York Central Railroad, the government engineers some time ago placed certain stakes, which marked the beginning and the ending of an accurately-measured nautical mile or knot. This course was laid off for the purpose of testing torpedo boats before their acceptance by the United States government. The sighting marks consist at each point of two poles, set up 150 feet apart, one near the water's edge and the other about 150 feet back of the New York Central tracks. When the observer on a vessel that is under test brings the two poles in line he knows that he is exactly at the starting point of the mile. Similarly when the poles at the end of the track are in line he knows that he is crossing the finishing line.

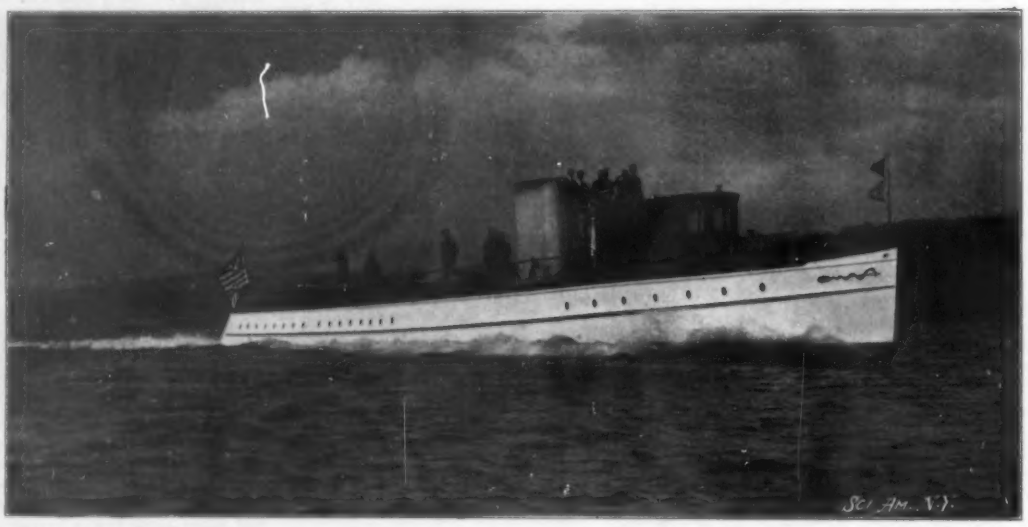
Over this course, and running at a distance of about 250 yards from the shore line, the steam yacht "Arrow" recently covered a nautical mile in exactly one minute and 32 seconds, or at the rate of 39.13 knots an hour. This is equivalent to 45.00 statute miles an hour and constitutes a new record for vessels of any kind whatsoever. The "Arrow" was designed by Charles D. Mosher, of this city, whose name is identified with the production of some of the fastest steam craft of the world, his "Ellide," a smaller vessel than the "Arrow," having steamed over the same measured mile at a rate of 34.72 knots an hour. Although the speed aimed at by the "Arrow" was extraordinarily high, namely 40 knots an hour, the uniform success which has attended the high speed trials of the Mosher boats, led those who have followed the performance of his craft, to expect that the designed speed would be reached.

The "Arrow" is a twin-screw yacht 130 feet 4 inches total length, 12 feet 6 inches beam, 3 feet 6 inches normal draft, with a displacement on that draft of 66 tons. In designing the vessel, particular attention was paid to the question of securing the greatest possible strength for the least weight of material; and the hull is unusually light considering the great power, 4,000 horse power, which is developed when the vessel is at full speed. The lines are similar to those with which we are familiar in the torpedo-boat destroyer, but they are greatly refined; and owing to the fact that the greatest beam lies well aft, and that this beam is continued out in the flat stern, the lines of the yacht are remarkably easy and well adapted to securing high speed results. The great sweetness of her model was shown in the fact that when the "Arrow" was steaming, in the earlier part of the mile trial, at a speed of over 40 knots an hour, she made remarkably little fuss, there being no lofty and crested bow wave, such as is seen at the high speed trials of torpedo boats.



Copyright 1901, by Paiser & Potter.

Twin-Screw, Quadruple Expansion Engines of the "Arrow." Horse Power, 4,000.



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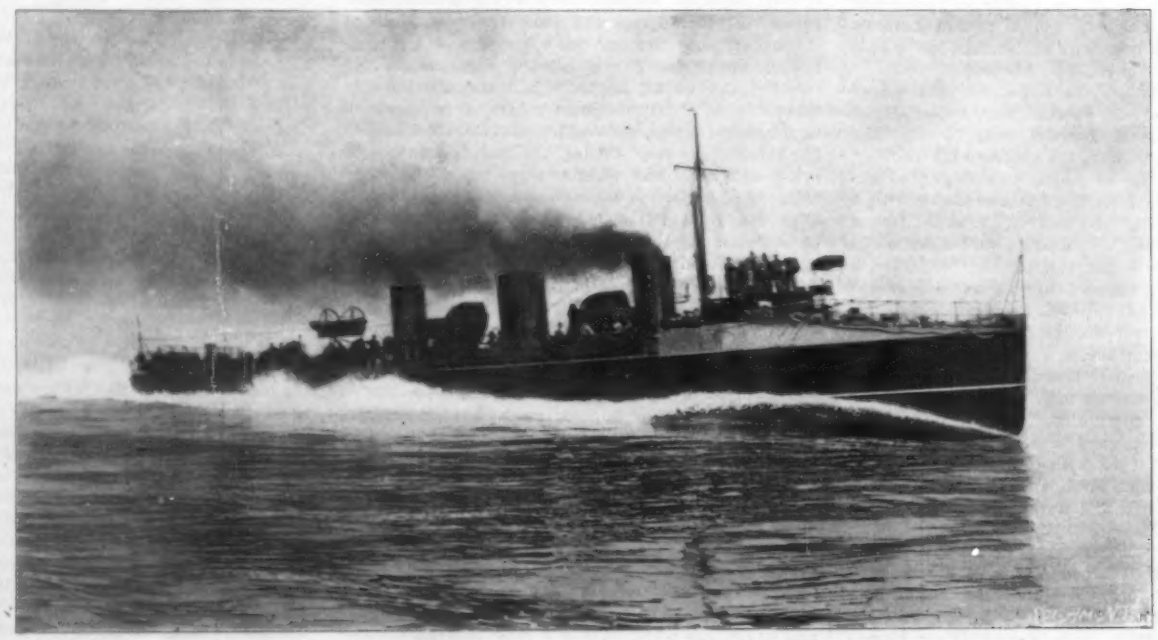
STEAM YACHT "ARROW." FASTEST CRAFT IN THE WORLD. SPEED ON TRIAL, 39.13 KNOTS.

Length, 130 feet 4 inches; beam, 12 feet 6 inches; draft, 3 feet 6 inches; displacement, 66 tons; horse power, 4,000.



"VELOX," FASTEST DESTROYER AFLOAT. SPEED, 33.64 KNOTS.

Fitted with reciprocating engines for cruising and with turbines for full speed. Length, 210 feet; beam, 21 feet; draft, 7 feet; displacement, 415 tons; horse power, 10,000.

The construction of the boat is composite in character, steel frames below the water line and aluminium above, except in the boiler and engine room spaces, where they are of steel throughout. Keelson, lower plates, reverse frames, bunkers, bulkheads, boiler saddles, engine foundations and other details are also of steel. The sides are double planked with mahogany, which is brought to a smooth fair surface and highly finished. Deck beams are aluminium bulb angles, while aluminium is used also for many other details. The vessel is strengthened longitudinally by diagonal strappings of steel plates.

The motive power consists of two Mosher water-tube boilers, containing a grate surface of 120 square feet and a heating surface of 5,540 square feet, the weight empty of each boiler being 6.43 tons. The boilers were designed to supply steam at 440 pounds to the square inch, although on the trial the pressure never exceeded 400 pounds to the square inch, that being the limit allowed by the inspectors. The twin-engines, of which we present an illustration, are of a type which has been specially designed for these high speed craft. They are quadruple expansion, with cylinders of 11, 17, 24, and 32 inches diameter by 15 inches stroke. The working pressure varies from 350 to 400 pounds per square inch and the revolutions from 540 to 600. The calculated power developed under 540 revolutions and 350 pounds pressure at the engine is 4,000 horse power. Both engines exhaust into one condenser with a cooling surface of 2,760 square feet. Between the steam cylinders there is installed a series of re-heaters, each one of which is capable of supplying the entire thermal equivalent of the work expended during the expansion, thus keeping the steam in a super-heated condition throughout its working cycle. These re-heaters dry the steam and prevent cylinder condensation.

The feed water before returning to the boilers is heated in four-stage feed-water heaters, being finally delivered to the boiler at a temperature of

about 350 degrees. From what we have said it will be seen that the development of power is very high for the weights involved. Thus the weight of the boilers per square foot of heating surface, when they are full of water, is 6.3 pounds. The indicated horse power per square foot of grate surface is 33, while the weight in pounds per horse power of engines, boilers, including water, and all auxiliaries, is only 17.78 pounds.

Points which make for high economy, and hence for a large return of power per pound of boiler and pound of coal may be summarized as follows: Great initial pressure (from 100 to 150 pounds greater than the common practice in high speed boats); the considerable wire-drawing from the boiler to the engine, tending to dry and superheat the steam and reduce the condensation, results which are also enhanced by the action of the re-heaters on the cylinders; and the reduction of the cylinder clearances in the engine to a very low value.

With regard to the results actually obtained, if we would estimate them in their full value, we must bear in mind that the designer, who has always superintended the speed trials of the earlier vessels, was absent on this occasion. There were, moreover, certain untoward circumstances connected with the trial which undoubtedly prevented the attainment of the fullest speed of the vessel. Judging from the fact that provision had been made by those in charge of the trial, for instantly opening the four safety valves on the two boilers, it would seem that there was a certain measure of nervousness in the engine room force which, in itself, would not conduce to securing the highest results. Cords had been tied to the safety valves and an engineer placed so that he could instantly open all four valves. The craft came down to the line at a speed which must have been something over 40 knots an hour and had proceeded, under a boiler pressure of 400 pounds per square inch, over about one-quarter of the mile course, when one of the safety valves lifted. At this instant the engineer told off to watch the valves, pulled the rope and released the other three, so that the "Arrow" completed the remaining three-fourths of the course with an enormous volume of steam blowing from her boilers. As a consequence the pressure ran down to 250 pounds, at which pressure it stood when the mile was completed. There was, in consequence, a visible falling off of the speed; but in spite of this the estimated speed of 40 knots an hour was closely approximated, the actual speed being 39.13 knots an hour. The sighting of the marks was done by one observer and the stop watch was held by another, the result being carefully checked by several watches on board, all of which agreed with the result given out by the timekeeper.

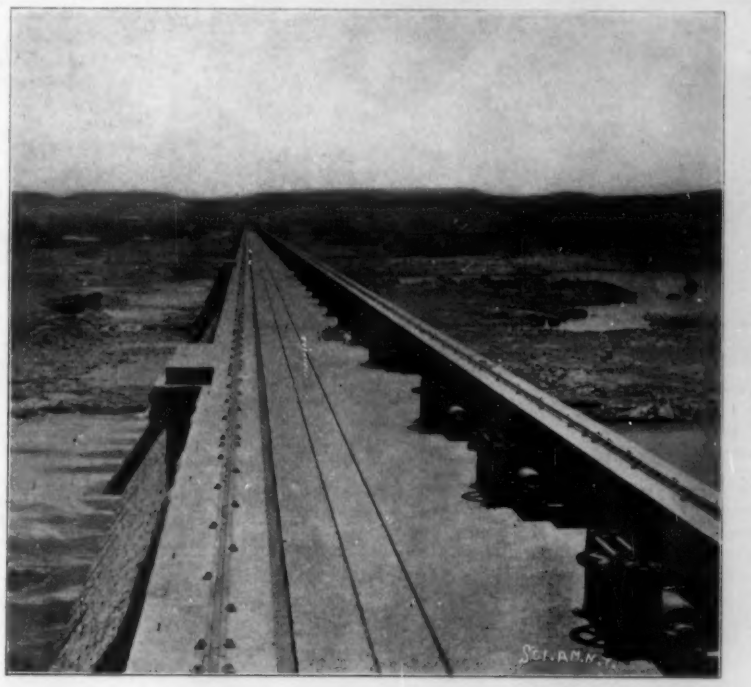
In discussing the results, the designer, Mr. Mosher, points out that the "Arrow" was drawing about 5 inches more than her designed normal draft of 3 feet 6 inches; that the boiler pressure, even at the starting point was forty pounds below the designed pressure; and that the vessel had not been out of the water for several months and, therefore, her bottom was not as clean as could be desired for a speed trial. These considerations would seem to justify the belief that when steaming on her designed lines and with a perfectly clean bottom, the "Arrow" would make, and probably somewhat exceed, a speed of 40 knots an hour.

We also present illustrations of the fastest torpedo-boat destroyer, the "Velox" of the British navy. She was constructed by the same builders as the ill-fated "Viper" and "Cobra," and like them is driven by turbine engines. Mr. Parsons of turbine fame had found that the "Viper" and the "Cobra" were not so economical as could be wished when running at ordinary cruising speeds. Passenger steamers run always at their highest speed, but warships only require their full power occasionally, and in common with all steam engines, the steam turbine does not show high efficiency when working much below the power for which it is designed. The arrangement arrived at in the "Velox" is as follows:

The main propelling machinery consists of two independent sets of Parsons turbine engines, one high-pressure and one low-pressure engine being on each side of the vessel. This gives four turbines, each of which has its own line of shafting, and, as each shaft carries two propellers, there are eight propellers in all. The high-pressure turbines drive the outer shafts and the low-pressure turbines the inner ones. For going astern reversing turbines are incorporated in the exhaust casing of each of the low-pressure cylinders. A novel feature in this vessel is the introduction of ordinary reciprocating engines fitted in conjunction with steam turbines. These engines are of the triple-compound type, and are coupled direct to the main turbines and work in conjunction with them. They take steam directly from the boilers, and exhaust through the high-pressure turbine, the exhaust from the latter passing in turn through the low-pressure turbine, and from thence to the condensers. These reciprocating engines are for use at cruising speeds, when low power only is needed, and are therefore of comparatively small size. When higher powers than those needed for absolute cruising speeds, under ordinary conditions, are needed, steam will be admitted to the turbines direct from the boilers; and when the highest speed is needed, which would bring the rate of revolution beyond that permissible with reciprocating engines, steam will be entirely cut off from the latter, they being at the same time thrown out of gear, and the steam turbines alone will be used. With this arrangement the "Velox" will doubtless prove an exceptionally economical destroyer at cruising speeds.

The boilers are of the Yarrow type, and have been made by Messrs. Hawthorn.

The hull of the "Velox" has been built by Messrs. Hawthorn, Leslie & Co. She is 210 feet long, 21 feet wide and 12 feet 6 inches molded depth. The maximum speed made by the "Velox" up to the present is 33.64 knots.

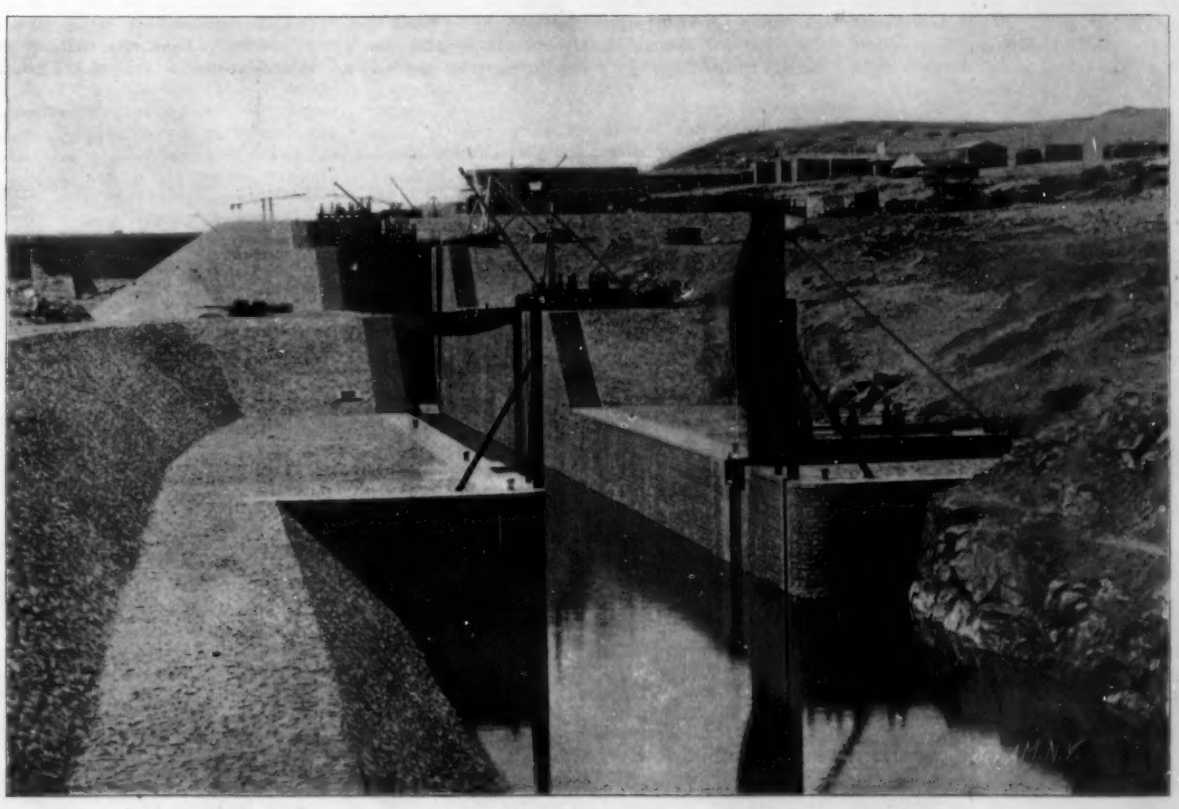


LOOKING TO THE EAST ALONG TOP OF DAM. REGULATING GEAR FOR SLUICES TO THE RIGHT.

THE NILE IRRIGATION WORKS.*

The monumental dam at Assouan, by far the greatest achievement of the kind in ancient or modern times, which will form a reservoir in the Nile Valley capable of storing 1,000,000,000 tons of water, will not only produce a revolution in the primitive and laborious methods of irrigation in Egypt, but will reclaim to the uses of the husbandman vast areas of land that hitherto have been accounted arid and worthless desert.

The old system of irrigation was little more than a high Nile flooding of different areas of land or basins surrounded by embankments. Less than a hundred years ago, perennial irrigation was first attempted to be introduced by cutting deep canals to convey the water to the lands when the Nile was at its low summer level. When the Nile rose, these canals had to be blocked by temporary earthen dams, or the current would have wrought destruction. As a result, they silted up, and had to be cleared of many millions of tons of mud each year by enforced labor, much misery and extortion resulting therefrom. About half a century ago the first serious attempt to improve matters was made by the construction of the celebrated Barrage at the apex of the Delta. This work consists, in effect, of two bricked arched viaducts crossing the Rosetta and Damietta branches of the Nile, having together 132 arches of 16 feet 4 inches span, which were



THE NAVIGATION CHANNEL—ENTRANCE TO LOCKS FROM THE NORTH.

*By the Special London Correspondent of the SCIENTIFIC AMERICAN. From information supplied by Sir Benjamin Baker, K.C.M.G., F.R.S., Engineer-in-Chief.

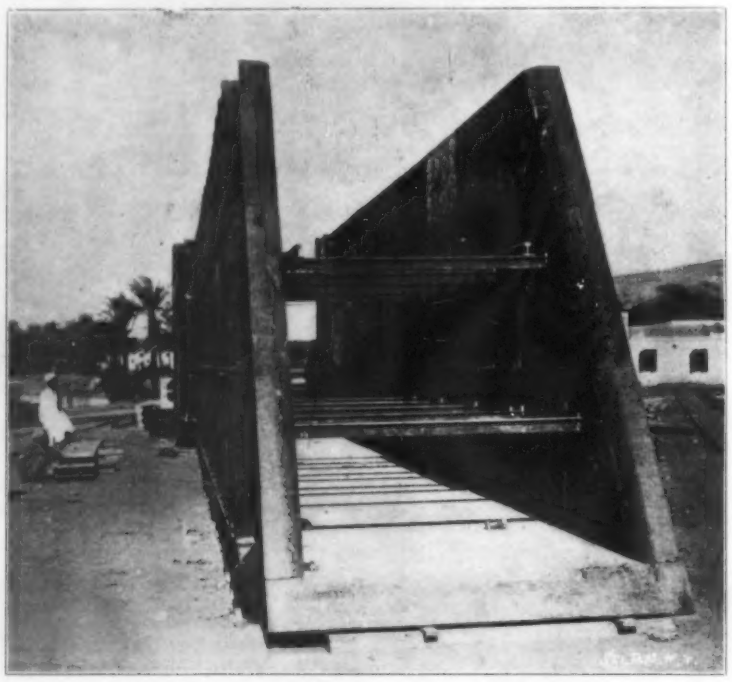
entirely closed by iron sluices during the summer months, thus heading up the water some 15 feet and throwing it at a high level into the six main irrigation canals below Cairo. In the summer months the whole flow of the Nile is arrested and thrown into the aforesaid canals. The old Barrage was constructed under great difficulties by French engineers, subject to the passing whims of their oriental chiefs. About fifteen years elapsed between the commencement of the work and the closing of all the sluices, and another twenty years before the structure was sufficiently strengthened by British engineers to fulfill the duties for which it was originally designed. Forced labor was largely employed in its construction, and at one time 12,000 soldiers, 3,000 marines, 2,000 laborers, and 1,000 masons were at work at the old Barrage.

In connection with the Nile reservoir, subsidiary weirs have been constructed below the old Barrage to reduce the stress on that structure. The system adopted was a novel one, devised by Major Brown, Inspector-General of Irrigation in Lower Egypt. His aim was to dispense almost entirely with plant and skilled labor; and so, without attempting to dry the bed of the river, he made solid masonry blocks under water by grouting rubble dropped by natives into a movable timber caisson. Both branches of the Nile were thus dammed in three seasons, at a cost, including navigation locks, of about $2,500,000. Many other subsidiary works have been and will be constructed, including regulators, such as that on the Bahr Yusuf canal.

By far the most important of the works constructed to enable the water stored up in the great reservoir to be utilized to the greatest advantage is the Barrage across the Nile at Assiout about 250 miles above Cairo, which was commenced by Sir John Aird & Company in the winter of 1898, and completed a few months ago. In general principle this work resembles the old Barrage at the apex of the delta; but in details of construction there is no similarity, nor in material, as the old work is of brick and the new one is of stone.

The total length of the structure is 2,750 feet, or rather more than half a mile, and it includes 111 arched openings of 16 feet 4 inch span, capable of being closed by steel sluice gates 16 feet in height. The object of the work is to improve the present perennial irrigation of lands in Middle Egypt and the Fayoum, and to bring an additional area of about 300,000 acres under such irrigation, by throwing more water at a higher level into the great Ibrahimich canal, the intake of which is immediately above the Barrage.

On the Nile the conditions are very special, and in some respects advantageous for the construction of dams and barrages. At Assiout the mode of procedure was to inclose the site of the proposed season's work by temporary dams or sudds of sandbags and earthwork, then to pump out and keep the water down by powerful centrifugal pumps, crowd on the men, excavate, drive the cast iron sheet piling, build the masonry platform and piers, lay the aprons of puddle clay and pitching, and get the work some height above low Nile level before the end of June, so that the temporary dams should not require reconstruction after being swept away by the flood. The busiest months were May and June, when in the year 1900 the average daily number of workmen was 13,000.



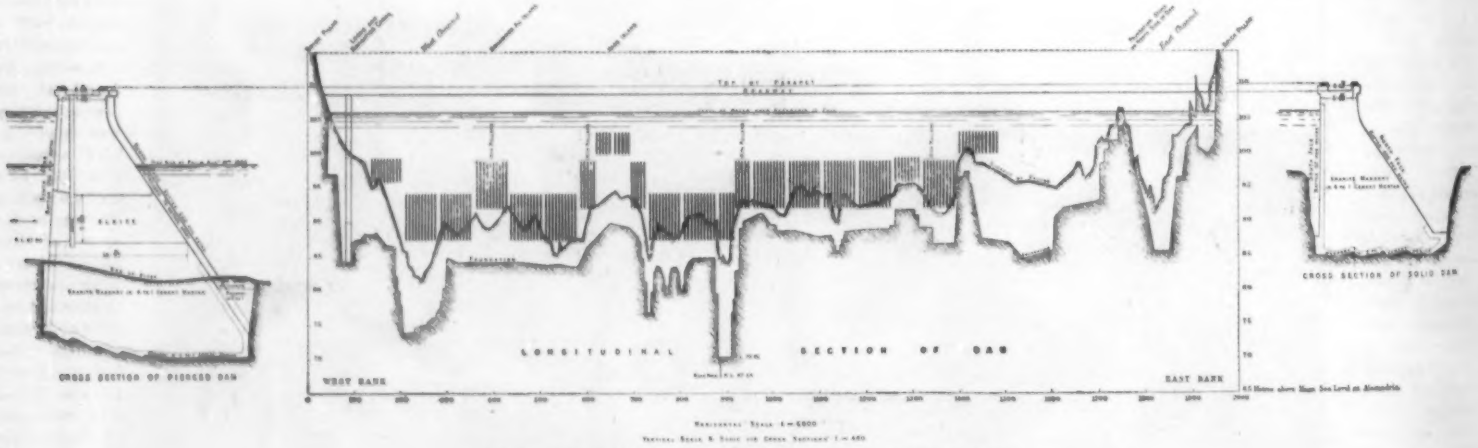
CAST IRON LINING FOR ONE OF THE SLUICES

Assiout, as already observed, is about 250 miles above Cairo. The great dam at Assouan is 600 miles above the same point. Between Assiout and Assouan the remains of many temples exist, of far greater interest and importance than those at Philæ. The latter ruins, however, have attracted more attention in recent days, because, being situated immediately above the dam, the filling of the reservoir will partially flood Philæ Island during the tourist season. It would be idle to speculate as to who first thought of constructing a reservoir in the Nile Valley, or who first arrived at the conclusion that the site of the present dam above Assouan was the best one. Mr. Willcocks, one of the ablest engineers of the Public Works Department of Egypt, who was instructed by Sir William Garstin to survey various suggested sites for a dam between Cairo and Wady Halfa, unhesitatingly decided that the Assouan site was the best, and the majority of the International Committee, who visited the site in 1894, came to the same conclusion. This conclusion had, however, been anticipated by Sir Samuel Baker more than forty years ago, from mere inspection of the site without surveys. This single dam proposed by Sir Samuel Baker forty years ago is in effect the one which is practically now completed. The Assouan dam is not a solid wall, but is pierced with sluice openings of sufficient area for the flood discharge of the river, which may amount to 15,000 tons of water per second. There are 180 such openings, mostly 23 feet high by 6 feet 6 inches wide; and where subject to heavy pressure when being moved they are of the well-known Stoney roller pattern.

The total length of the dam is about 1¼ miles; the maximum height from foundation, about 130 feet; the difference of level water above and below, 67 feet; and the total weight of masonry over one million tons. Navigation is provided for by a "ladder" of four locks, each 260 feet long by 32 feet wide. As remarked in the case of Assiout, the difficulties in dam construction are not in design, but in the carrying out of the works. When the "rotten rock" in the bed was discovered Sir Benjamin Baker reported to Lord Cromer frankly that he could not say what the extra cost or time involved by this and other unforeseen conditions would be, and that all that could be said was that, however bad the conditions, the job could be done. Lord Cromer replied that the dam had to be completed whatever the time and cost. The contract was let to Sir John Aird & Company, of London, with Messrs. Ransomes & Rapier, of London, as sub-contractors for the steel work, in February, 1898. Two months after signing the contract the permanent works were commenced, and before the end of the year thousands of native laborers and hundreds of Italian granite masons were hard at work. On February 12, 1899, the foundation stone of the dam was laid by the Duke of Connaught. Many plans were considered by the engineers and contractors for putting in the foundations of the dam across the roaring cataract channels, and it was finally decided to form temporary rubble dams across three of the channels below the site of the great dam, so as to break the force of the torrent and get a pond of comparatively still water up stream to work in. Stones of from 1 ton to 12 tons in weight were tipped into the cataract and this was persevered with until finally a rubble mound appeared above the surface of the water. The first channel was successfully closed on May 17, 1899, the depth being about 30 feet and the velocity of current nearly 15 miles an hour. In the case of another channel the closing had to be helped by tipping in railway wagons themselves, loaded with heavy stones and bound together with wire ropes, making a mass of about 50 tons, the great mass being necessary to resist displacement by the torrent.

These rubble dams were well tested when the high Nile ran over them; and on work being resumed in November, after the fall of the river, water-tight sandbag dams, or sudds, were made around the site of the dam foundation in the still waters above the rubble dams and pumps were fixed to lay dry the bed of the river. This was the most exciting time in the old stage of the operations, for no one could predict whether it would be possible to dry the bed, or whether the water would not pour through the fissured rock in altogether overwhelming volumes. Twenty-four 12-inch centrifugal pumps were provided to deal if necessary with one small channel; but happily the sandbags and gravel and sand embankments stanched the fissures in the rock and interstices between the great bowlders covering the bottom of this channel, and a couple of 12-inch pumps sufficed.

The masonry of the dam is of local granite, set in British Portland cement mortar. The interior is of rubble set by hand with about 40 per cent of the bulk in cement mortar, four of sand to one of cement. All the face work is of coursed rock faced ashlar, except the sluice linings, which are finely dressed. This was steam crane and Italian masons' work. There was a great pressure at times to get a section completed before the inevitable rise of the Nile, and as much as 3,600 tons of masonry was executed per day, chiefly at one point in the dam. A triple line of railway and numerous trucks and locomotives were provided to convey the materials from quarries and stores to every part of the work. The maximum number of men employed was 11,000, of whom 1,000



LONGITUDINAL AND CROSS SECTIONS OF THE ASSOUAN DAM.

were European masons and other skilled men. Mr. Wilfred Stokes, chief engineer and managing director of Messrs. Ransomes & Rapier, was responsible for the detailed designing and manufacture of the sluices and lock gates; 140 of the sluices are 23 feet high by 6 feet 6 inches wide, and 40 of them half that height; 130 of the sluices are on the "Stoney" principle with rollers, and the remainder move on sliding surfaces. The larger of the Stoney sluices weigh 14 tons, and are capable of being moved by hand under a head of water producing a pressure of 450 tons against the sluice.

There are five lock gates, 32 feet wide, and varying in height up to 60 feet. They are of an entirely different type from ordinary folding lock gates, being hung from the top on rollers, and moving like a sliding coach house door. This arrangement was adopted for safety, as 1,000,000,000 tons of water are stored up above the lock gates, and each of the two upper gates is made strong enough to hold up the water, assuming the four other gates were destroyed.

When the river is rising the sluices will all be open, and the red water will pass freely through, without depositing the fertilizing silt. After the flood when the water has become clear, and the discharge of the Nile has fallen to about 2,000 tons per second, the gates without rollers will be closed, and then some of those with rollers; so that, between December and March the reservoir will be gradually filled. The reopening of the sluices will take place between May and July, according to the state of the Nile and the requirements of the crops.

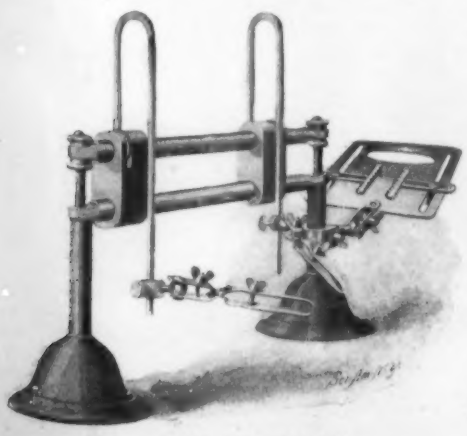
Between December and May, when the reservoir is full, the island of Philæ will in places be slightly flooded. As the temples are founded party on loose silt and sand, the saturation of the hitherto dry soil would cause settlements and no doubt injury to the ruins. To obviate this risk, all the important parts, including the well-known Kiosk, or "Pharaoh's bed," have been either carried on steel girders or underpinned down to rock; or, failing that, to the present saturation level. It need hardly be said that, having regard to the shattered condition of the columns and entablatures, the friability of the stone, and the running sand foundation, the process of underpinning was an exceptionally difficult and anxious task.

At present it is impossible to estimate the far-reaching beneficial influence these irrigation works will bestow upon Egypt, but the reclamation of so many thousands of acres of desert for agricultural development cannot fail to improve the agricultural possibilities of the land and assist Egypt to regain the prosperity it enjoyed in the era of the Pharaohs.

UNIVERSAL WORKHOLDER.

The intricate and delicate work of the jeweler's art may be greatly simplified by the employment of the universal workholder, such as the one herewith illustrated. This device, which is the invention of Messrs. Everett G. Couch and Nelson D. Wells, of Southern Pines, N. C., permits of the finest adjustments and will securely hold the material to be operated on in any desired position.

In the construction of the device two standards are employed, having their upper ends reduced and threaded. Supported on these threaded ends are two parallel bars, on the upper one of which a screw-thread is cut. Movable on these rods are two carrier blocks, each provided with a nut which engages the thread on the upper rod and by means of which the blocks may be given a lateral adjustment. Slight vertical adjustment may be had by operating the nuts on the standards, and thereby raising or lowering the threaded rod. A U-shaped wire arm secured to each block forms a support on which the joint block of the tweezers is mounted to slide. The tweezers have a ball-and-socket connection with the joint block, so that they may be secured at any desired angle by the manipulation of a thumb-nut, and they may also be secured at any height on the wire arm by tightening a thumb-screw in the joint block; thus an unlimited variety of angles may be obtained.



UNIVERSAL WORKHOLDER.

The value of the device will be readily appreciated by the jeweler. The delicate horizontal adjustment permits a joint when made to be opened for the insertion of solder and closed again without the slightest variation. If desired, the tweezers may be moved apart sufficiently to be swung in line with each other, so that a successful butt-end joint of the smallest gold wire can be made. Additional tweezers may be easily mounted where required.

Adjustable on one of the standards is a clamping block to which a plate is secured by a ball-and-socket joint. Near its outer end this plate is provided with an opening in which a small receptacle may be placed for heating water, a lamp being situated underneath the same. Since the plate is attached to the standard by a universal joint, it will be found useful for holding charcoal, against which the work held by the tweezers may be placed while soldering. The charcoal is held between toothed jaws having slotted shanks which permit adjustment for the varying widths of charcoal, while the same may be secured at any desired position along the slots at each side of the plate The entire device is characterized by its simplicity of construction which, nevertheless, does not detract from its efficiency for the most varied requirements.

AN IMPROVED KNIFE.

A patent has recently been granted to Mr. Newton E. Putney, of Southbridge, Mass., for an improvement in tools, such as knives, awls and the like having slidable blades or sheaths. The invention provides a tool of this type which can be readily manipulated with one hand to bring the blade into active cutting position or to conceal the same against possible injury to persons coming into contact with it.

IMPROVED KNIFE.

Our illustration shows a knife having this improved construction. The handle of the knife contains a longitudinally-extending recess in which a metal lining, *C*, is fitted. This lining, which is tubular in shape, is contracted at the inner end so as to be engaged by a transverse pin, *G*, secured in the handle. This pin also engages the inner end of the shank, *A*, of the knife blade. The knife blade is normally concealed within a sheath, *E*, having a tubular extension mounted to slide within the lining, *C*. A shoulder is formed on the inner end of this extension against which one end of the coil spring, *D*, presses, the other end resting against the bottom of the lining. The spring serves to move the sheath to its outermost position, concealing the knife blade. When, however, it is desired to use the knife the sheath is moved back and held in this position by a spring catch, *B*, riveted at one end to the knife blade and at the other end engaging the sheath through an opening in the same. A finger piece is provided on the sheath to enable one more easily to uncover the blade; while the spring-catch is so arranged that by slight pressure of the finger it will be disengaged and the sheath will be moved out under spring tension to conceal the blade. The knife will be found very serviceable for use in stores to cut twine, or for use by carpenters and other mechanics; for it may be safely carried in the pocket without danger of cutting the same, and yet may be readily and quickly brought into cutting position.

A STALL FOR HORSES OR CATTLE.

In the accompanying illustration we show a new form of stall for horses and cattle which embodies a number of important features. The stall is provided with a movable floor whereby it may be adjusted for animals of different sizes; it is further provided with an adjustable feed-rack mounted to swing over a water-trough and feed-trough so as to cut out one or both of the troughs and permit an attendant to fill them without entering the stall.

The construction of the stall is as follows: The feed-trough, *A*, and water-trough, *B*, are both supported by brackets, *M*. The feed-rack, *C*, which is adapted to hold hay or like food, is swung on pivots in the side walls of the stall and is arranged to just clear the top edges of the troughs. A bolt at the bottom of the rack serves to lock the same in its different positions. The normal position, which is shown in full lines in the engraving, affords the animal free access to the feed-trough, but cuts out the water-trough. When it is desired to fill the feed-trough the rack, *C*, is moved into position, *J*, indicated by dotted line. In order to water the animals the rack, *C*, is moved back into position, *K*.

Resting on the stable floor, *H*, are the floor sections, *B*, which may be moved back into position, *L*, when necessary to accommodate larger animals. These floor sections are provided with channels into which are fitted the strips, *E*, for directing the drainage against the deflector boards, *F*, and thence into a conduit, *G*, formed in the stable floor, *H*. The deflector boards are required more particularly when the floor sections are drawn outward to position, *L*. When it is desired to clean the stable floor the stall floor sections may be wholly removed and thorough cleansing will thus be permitted.

A patent for this construction has recently been

ADJUSTABLE STALL FOR HORSES OR CATTLE.

granted to Mr. Richard Smith, of Fort William, Ontario, Canada.

A NEW TYPE OF WATER COOLER.

In these days of sanitary precautions there is an increasing demand for pure drinking water. Physicians have succeeded in teaching the general public the evils of the ordinary ice water cooler, and, as a consequence, a number of improved coolers have been put on the market. Among these is one invented by Mr. Charles F. Conover, of 406-420 East 53d Street, New York city. This cooler is more particularly designed for cooling distilled aerated mineral waters and other liquids contained in large glass bottles. The construction permits of conveniently drawing off the liquid and cooling the same without bringing it into direct contact with the cooling medium. The cooler is provided with a bracket, *F*, extending upward, on which the water bottle or demijohn is supported. The stopper of this bottle is provided with an air-vent pipe, *A*, and a siphon pipe, *B*, the latter being connected by a flexible tube with the outer end of the coil, *C*, resting on the bottom of the cooler. The inner end of this coil leads to a faucet, *G*, through which the water may be drawn off into a tumbler, supported on the drip-pan, *D*. Ice is placed on the coil, *C*, to cool off the water circulating therein. The cooler is provided with a bottom pan, into which the drainage from the ice and from the drip-pan, *D*, flows. The faucet, *E*, connects with this pan and affords the means through which the waste water may be drained off. The flexible connection on tube, *B*, is preferably provided with a device by which it may be closed whenever it is disconnected from the siphon-pipe at the time an empty bottle is being replaced by a filled one. As soon as proper connection with the coil has been made, the siphon action begins; for the level of the liquid in the bottle is above the highest point of the siphon pipe.

This form of water cooler embodies many excellent advantages. Primarily, of course, the water is cooled without being contaminated by contact with the ice. Again, only a small amount of water is cooled at a time, so that when a fresh bottle has been connected up, one does not need to wait until its entire contents have been cooled before obtaining a glassful of cold water. Mr. Conover's cooler will further be found very economical in its consumption of ice. Aside from these, other advantages which our limited space prevents us from enumerating, will readily suggest themselves to our readers.

A NEW FORM OF WATER COOLER.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PLOW.—H. BRYAN, Modesto, Cal. This invention is an improvement in the class of wheeled-plows, more particularly gang plows, whose frame is supported at the rear end by a wheel adapted for vertical adjustment for the purpose of varying the depth of the furrow or for supporting the plows proper above the surface of the ground when the plow is being hauled or shipped.

CORN-SHOCK CARRIER.—N. W. LYON, Brighton, Iowa. The object of this invention is first the provision of a simple and strong construction adapted to be turned up on end for ready loading of an upright shock on the vehicle; secondly, to provide means for binding the shock to the vehicle in an expeditious manner, and thirdly, to provide impaling devices adapted to co-operate with the binding devices and securely hold the shock on the vehicle against any tendency to become displaced.

Electrical Apparatus.

INCANDESCENT ELECTRIC LAMP.—G. C. WEBSTER, Warren, Ohio. The filament of this lamp is so arranged as to produce a maximum and symmetrical distribution of light rays. Filaments have heretofore been so constructed as to produce superior illumination in a vertical plane or downward direction, and others have given superior lateral distribution. In this invention, however, both effects have been attained.

ELECTRIC ACCUMULATOR-PLATE. — A. FISCHER, Berlin, Germany. This accumulator plate consists of sheets of lead folded into serpentine form; the objects attained by this improved form are, first, that the plates are stiffened—that is, prevented from being straightened out in any degree—and, second, that their active surface is increased.

Hardware.

COMBINATION-TOOL.—J. L. WOOD, Fulton, and W. G. LAWRENCE, Cordova, Ill. This tool has the general form of a monkey-wrench in which various other implements are embodied by certain novel features of structure. The tool is particularly useful to bicyclists and automobile drivers, comprising as it does, a hammer, two spoke wrenches and a socket wrench, as well as a monkey-wrench.

SQUARE.—A. L. LUNDGREN, Pullman, Ill. Mr. Lundgren has invented a new drawing and measuring instrument which will be found useful to carpenters and other mechanics. The instrument is arranged for convenient adjustment to give any desired angle and is adapted to be folded into a comparatively small space.

Mechanical Devices.

ROLLER-BEARING.—JOHN D. TWIGGS, JR., Augusta, Ga. The invention relates to axle journals and bearings for rolling stock, and other devices and machines. The bearing is arranged to reduce the friction of the parts to a minimum, to hold the rollers in position when opening the bearing for examination or repairs, to insure a proper lubrication of the parts at all times, and to render the bearing dust-proof.

AUTOMATIC FAN.—J. D. WILLIAMS, Denning, Ark. The invention is an improvement in that class of automatic fans which are designed to be placed upon tables in dining-rooms, sick-rooms and other places, for creating a breeze of air and driving away flies or other troublesome insects. The chief features of novelty are the means for supporting the fan shaft and securing it detachably, and for adjusting the fan blades on the shaft.

CONSECUTIVE-NUMBERING APPARATUS.—O. G. BARTUSCH, Brooklyn, N. Y. An improved consecutive-numbering apparatus is provided in this invention, which is arranged to actuate one set or a plurality of sets of numbering wheels simultaneously and to allow of adjusting the sets nearer to or farther from each other, to suit the conditions of the work to be performed without disconnecting the sets from the driving mechanism.

APPARATUS FOR MOUNTING PHOTOGRAPHS.—I. G. GRANT, Bozeman, Mont. Mr. Grant has invented a new machine for mounting photographs upon their cards or mounts. This machine enables the work to be done properly and in less time than is taken by the present hand method.

AUTOMATIC CAR AND ELEVATING TRACK.—W. L. MCLAUGHLIN, Clearlake, Iowa, and J. E. SWENSON, Lake Crystal, Minn. An improved automatic car and elevating track is provided by this invention whereby grain, corn, coal, sand and the like may be elevated and dumped. The apparatus is arranged to automatically open the locked car-gate for discharging the cargo into the chute leading to the place of discharge and to automatically close and lock the gate when the car reaches its receiving position.

WINDMILL.—T. W. LOWE, Stockton, Cal. The construction of the windmill is such that the vanes will catch any breeze that may be stirring, thus making the wheel run in very light winds. The effective area of the vanes may be varied either by automatic mechanism or by hand-controlled devices. The vanes are self-adjusting according to winds of the desired strength, thus preventing the wheel from running at excessive speeds in case of high winds, and affording a construction which requires very little lubrication.

Railway Improvements.

RAILROAD-BED.—MARTIN HAAS, Kalamazoo, Mich. A bed of novel construction is hereby afforded, upon which the rails may be directly supported without the use of crossties. The invention consists broadly in a cement bed upon which the rails rest, the bed having embedded within it longitudinal and transverse twisted or corrugated wires or strips.

MAIL DELIVERING AND CATCHING DEVICE.—W. J. NOBLE, Philadelphia, Pa. Mr. Noble has invented an improved mail delivering and catching device which is arranged to positively deliver a mail pouch or bag from a passing train to a track station and simultaneously cause an outgoing mail pouch to be picked up by the train from the station.

DUST-GUARD.—J. S. PATTEN, Baltimore, Md. Mr. Patten is the inventor of two forms of dust guards for use in boxes of railway cars. The guards are cheaply and efficiently constructed for application to the ordinary box without necessitating any change of structure therein. In the first construction, the packing strip is in the form of an annular plaited flax strip having a central opening of desired bore and made of general elongated form to hold it from turning with the axle. In the second construction the packing section is in the form of a frame pressed from a sheet of metal forming a face-plate and a center pocket in which the flax packing is held. A cover-piece is provided for securing the packing in place.

Vehicles and Their Accessories.

ARMOR FOR VEHICLE-TIRES.—C. H. PASCHKE, Buffalo, N. Y. The invention provides an inflatable tire for vehicles with a novel protective armor which is light, strong, and durable and which will afford increased bite for frictional contact with the road bed, thus preventing slipping of the wheels. The invention is particularly adapted for use on the wheels of heavy automobiles, road wagons, carriages, and the like.

Miscellaneous Inventions.

PACKING-RING. — H. KIRSCHNING, 133 Ackerstrasse, Berlin, Germany. An improved packing-ring is hereby provided in the manufacture of which one or more sheet metal strips are pressed edge foremost into the ring. By means of the insertion of the metal strip, a reliable packing is obtained, having great strength and increased stiffness, so that the rings may be subjected to severe strains without danger of fracture or bending.

GUN-CLEANER.—G. H. GARRISON, Bucoda, Wash. The invention relates to improvements in devices for cleaning the interior of a gun-barrel, the object being to provide a simple means for expanding the swab while operating in the gun-barrel. A resilient vermicular core extends lengthwise through the swab whereby when the swab is compressed longitudinally it will be circumferentially expanded.

FOOT-WARMER FOR VEHICLES.—G. W. DUNHAM and J. W. FOX, East Cleveland, Ohio. This foot-warmer is adapted to utilize the waste heat resulting from combustion for propulsion of a vehicle, such as an automobile actuated by a motor using gas or steam for its motive agent, or to utilize the water-cooling circulation of automobiles actuated by gasoline.

STOVE OR RANGE.—G. A. TUCKFIELD, Salt Lake City, Utah. Mr. Tuckfield has invented improvements in stoves or ranges which comprise a simple means for increasing or diminishing the fire space and grate area so that more or less fire may be maintained, as the case may require, resulting in an economy of fuel when a small fire is desired.

PROCESS FOR EXTRACTING PRECIOUS METALS.—W. HILT, Coles, Cal., and C. E. LANE, Ashland, Ore. Messrs. Hilt and Lane have invented a new process for precipitating precious metals from their solutions. The process consists in producing zinc vapor and condensing the same beneath the surfaces of said solutions, thereby causing the zinc to replace the precious metals in the solutions.

ARTIFICIAL STONE.—F. BOAS, St. Hyacinthe, Can. The invention has reference to artificial stones which are obtained by the action of high or low pressure steam on a mixture of sand with material containing alkaline earth, and it is distinguished from the processes heretofore in use by employing silicate of magnesia as a chief agent for effecting the solidification of the mixture.

COMBINED UNDERVEST AND CORSET-COVER.—C. DUPOUR, Savannah, Ga. This improved lady's garment combines an undervest and corset-cover and is arranged to permit the wearer to readily use the garment as an undervest for the protection of the chest, back, and arms when wearing an ordinary dress or to employ the garment as a corset-cover when wearing a low-necked dress.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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AUTOS.—Duryea Power Co., Reading, Pa.

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For mining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 3158.—For dealers in old rubber.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 3159.—For makers of heaters using wood for fuel.

WANTED.—You to read ad. page 195 Metal Working Plant for Sale.

Inquiry No. 3160.—For photographic nickel-in-the-slot machines.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3161.—For makers of molds for making soap.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 15, Montpelier, Vt.

Inquiry No. 3162.—For manufacturers of engraving machinery for button making.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Bldg., Rochester, N. Y.

Inquiry No. 3163.—For makers of portable saw mills.

Die work, experimental work and novelties manufactured. American Hardware Mfg. Co., Ottawa, Ill.

Inquiry No. 3164.—For makers of small clamps for paper.

Book "Dies and Diemaking," 100 6x9 pages. $1, postpaid. Send for index. J. L. Lucas, Bridgeport, Conn.

Inquiry No. 3165.—For steel framing, girders, etc., for the construction of buildings.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 3166.—For makers of appliances for distributing a dry powder fire extinguisher on fires.

IDEAS DEVELOPED.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 584 Hudson Street, New York.

Inquiry No. 3167.—For an ice machine, capacity 300 pounds per day.

Automobiles built to drawings and special work done promptly. The Garvin Machine Co., 149 Varick, cor. Spring Streets, New York.

Inquiry No. 3168.—For parties to manufacture patent cutlery.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3169.—For makers of hand and steam laundry machinery.

FOR SALE.—Patent No. 670,482. Hat-fastener. Clasps head as did elastic, but is concealed under hair. Address Dr. Emma T. Willis, Urumia, Persia.

Inquiry No. 3170.—For information relative to the use of compressed air for elevating water from deep wells.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3171.—For a machine for breaking eggs and separating the shells.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3172.—For makers of small electro-magnets.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 3173.—For makers of automatic magnet winders.

WANTED.—Machines for splitting cane for manufacturing chairs, etc. Send catalogues and best prices. W. E. Richardson, Boustead Institute, Singapore, Straits Settlements.

Inquiry No. 3174.—For manufacturers of novelties and specialties.

One of the handsomest tool catalogues has just been issued by Montgomery & Co., 105 Fulton St., New York. There is hardly a tool manufactured which is not illustrated and described in this useful volume. Every mechanic should have one.

Inquiry No. 3175.—For dealers in diving suits and submarine workers' supplies.

WANTED.—Assistant superintendent in factory employing 400 men. Must be familiar with shop practice and methods, and capable of handling men. state age, experience, reference and salary required. Address the Ohio Brass Company, Mansfield, Ohio.

Inquiry No. 3176.—For makers of aluminium combs.

WANTED.—A capitalist to take half of a valuable lot of patents for the United States in the hands of a company, and would be director in the general branch. This company will eventually outvie the Steel Trust. Must deposit one hundred and fifty thousand dollars. He would receive ten thousand shares in the general branch in addition to half of the patents business of the United States. For information apply to manager of Joyce Manufacturing Company,

Prince Albert Sask.
Northwest Territory, Canada.

Inquiry No. 3177.—For makers of sheet steel shovels, forks, picks, etc.

Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 3178.—For dealers in second-hand gasoline engines and launches.

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Inquiry No. 3180.—For parties to manufacture hooks and eyes.

Inquiry No. 3181.—For makers of machines for grinding leather.

Inquiry No. 3182.—For parties to do twisted wire work in large quantities.

Inquiry No. 3183.—For power machines for perforating sheet metal.

INDEX OF INVENTIONS

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September 9, 1902,

AND EACH BEARING THAT DATE.

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Belt stud or fastener, Linderman & Bing	708,565
Belt tightener, W. E. Bee	708,856
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Bolt machine, C. K. Lassiter	708,891
Bone black kiln, W. T. Mohr	708,898
Boring and drilling machine, B. E. Hervey	708,881
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Bottle stopper, M. Pitts	708,732
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Bottles or jars, metal cap for, C. A. Callerson	708,528
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Car door, flush, K. Osel	708,914
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Cars, emergency brake for tramway, C. Real	708,734
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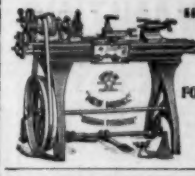

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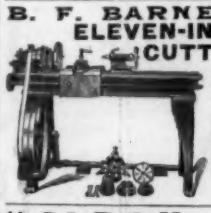

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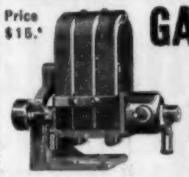

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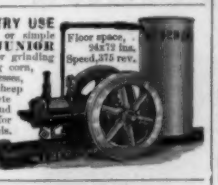

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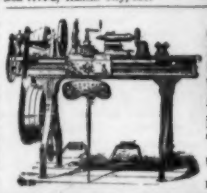

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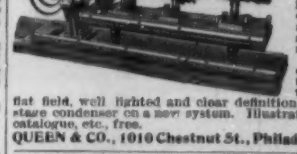

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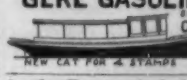

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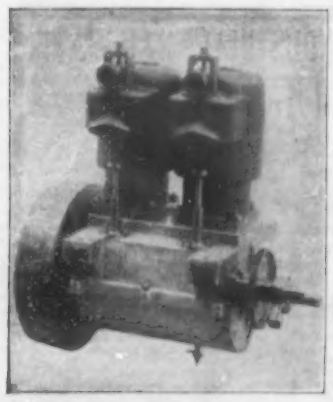

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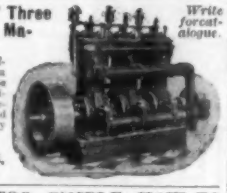

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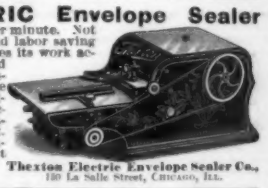

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Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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(8688) R. G. R. writes: In the SCIENTIFIC AMERICAN, July 5, 1902, I read an article by Mr. Collins regarding a simple receiver for wireless telegraphy. I have constructed the receiver, adhering closely to instructions, but am unable to make it work. The sending and receiving stations are about three-quarters of a mile apart, each has an insulated air wire about 30 feet long bared for about 3 feet at the upper end. The earth wire is attached to a water-pipe. A Morse telegraph key is used for sending; two Leclanche cells at the receiving station and two at sending station. Wire 1-12 inch in diameter is used for coherer. No coherer used at sending station. Air wire connected with key, key connected to battery, and wire from battery to ground. A. In your description of your wireless telegraph apparatus you do not mention an induction coil in the transmitting circuit to produce the electrical waves. The complete apparatus for both transmitting and receiving stations is described by Mr. Collins in an article in the SUPPLEMENT No. 1363, which we can send you for ten cents. To make a suitable induction coil you will need also SUPPLEMENT No. 160, price also ten cents.

(8689) I. D. asks for a formula for bluing iron and steel without heating. A. 1. From our Cyclopedia of Receipts, Notes and Queries: Scour the steel with a small quantity of a strong aqueous solution of soda, rinse in water, warm and brush over with a solution of ¼ of an ounce chloride of iron, dissolved in 5 ounces of water, and let it dry; then apply in the same manner a solution of 1-5 of an ounce pyrogallic acid in 1 ounce of water, dry, and brush. Does not wear well without lacquering. 2. The blue oxide is sometimes imitated by using a thin alcoholic shellac varnish, colored with aniline blue or Prussian blue. 3. To blue steel without heat, mix finely-powdered Prussian blue with rather thin shellac; gently heat the steel and apply the varnish. 4. Iron and Steel to Blue Without Heat—Solution of potassium ferricyanide and water, 1:200; solution of ferric chloride, 1:200. Mix the two solutions and dip. 5. Antimony trichloride, 25 parts; nitric acid, fuming, 25 parts; and hydrochloric acid, 50 parts. Apply with a rag and rub until the proper color is obtained with a piece of green oak.

(8690) A. C. L. asks: Is it possible to convey a current of electricity from a battery, stored in a locomotive, to the rail, through the axle and wheel? Does not the oil bearing interfere with a perfect connection? A. We presume it is possible to convey a current of electricity from the locomotive to the rail through the axles and wheels, though we never tried the experiment. We think so, because the current from the overhead trolleys goes through the motor and the axles to the rail and returns to the power house in that way only.

(8691) M. G. M. asks: 1. With a current of 20 volts and where bare copper wire is used, is there any waste of same current where nothing but dry pine is used for insulation? A. There is always some leakage of current when bare wire is in contact with wood, and even over insulators, especially in wet weather. But in the case above there would not be much leakage so long as the wood is dry. 2. How many feet of No. 36 tinned iron wire like the inclosed has a resistance of 10 ohms? A. Iron has very nearly six times the resistance of copper. No. 36 copper wire has 2.408 feet per ohm. Ten ohms of No. 36 iron wire would be 4.02 feet long.

(8692) G. B. D. asks: Can you tell me how to construct a lamp or light that will burn under water (outside of an electric device). Any hints how to proceed will be appreciated. A. Any lamp will burn under water if protected from the water and supplied with air. We do not know any other way to produce a light under water. An electric light does not need air, a fact which renders it easier to have light under water by electricity, but this is out of the question with you. The metal potassium will burn under water. No means has been devised for utilizing the fact for illumination. Its cost is too great for such a use.

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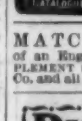
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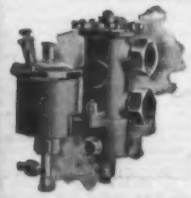

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